creative computing

November 1979
vol 5, no 11
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the #1 magazine of computer applications and software

Comparison Chart of 6 Popular Personal Computers

Comparison of Single Board Computers

Electronic Toys and Games

Quick Printer II

Introl Home Control System

Cover Feature: Computer Art Exhibition

Car Pooling and Personal Computers

Adventure Game: Complete Listing in Basic

Interact Computer

Mumps Language

Build Your Own: Joysticks and Telephone Dialer

Controlling Household Devices

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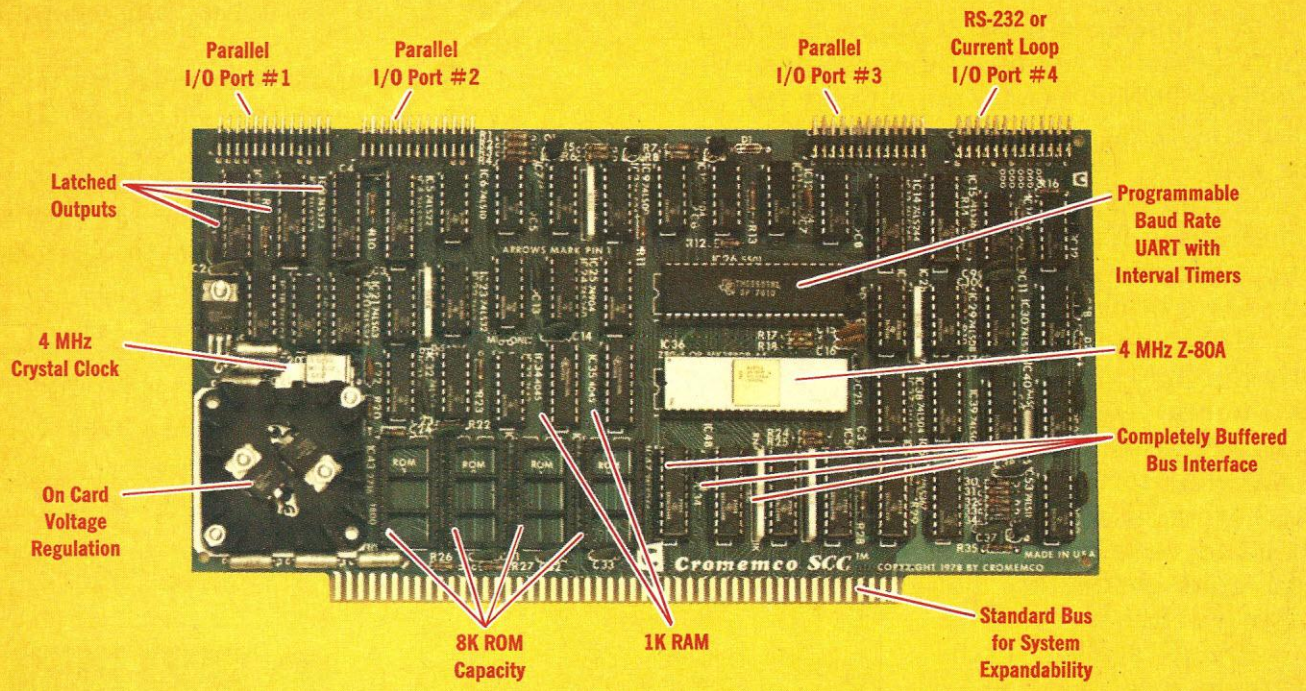

The single card computer with the features that help you in real life

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In this advanced card you get a professional quality computer that meets today's engineering needs. And it's one that's complete. It lets you be up and running fast. All you need is a power supply and your ROM software.

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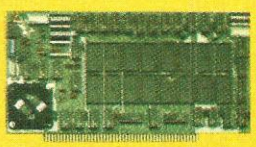
Card Cage



32K BYTESAVER PROM card

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Another convenience that makes the Model SCC computer easy to use is our Z-80 monitor and 3K Control BASIC (in two ROMs). With this optional software you're ready to go. The monitor gives you 12 commands. The BASIC, with 36 commands/functions, will directly access I/O ports and memory locations — and call machine language subroutines.

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Both microcomputers provide 32K static memory, two serial I/O ports, a 2 MHz processor board, a 2K RAM monitor, a nine-slot motherboard with built-in baud rate generator and gold connectors for high reliability. The Chieftain's stylish leather-grained cabinet houses the above with its own cooling fan and regulated power supply.

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And it's expandable to 64K memory with up to 2 megabytes floppy disk storage.

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The Cover

The cover is by Ruth Leavitt and was one of the works of art on exhibit this past summer at the Westlake Gallery (see article on page 84). The program used to produce the graphic simulates stretching a geometric form and distorting it as though the design were on a rubber sheet. The computer produces its output on film which is then enlarged and made into a silk screen by hand. The final work is screened by hand in various colors to produce a striking effect.

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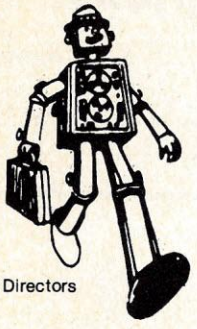

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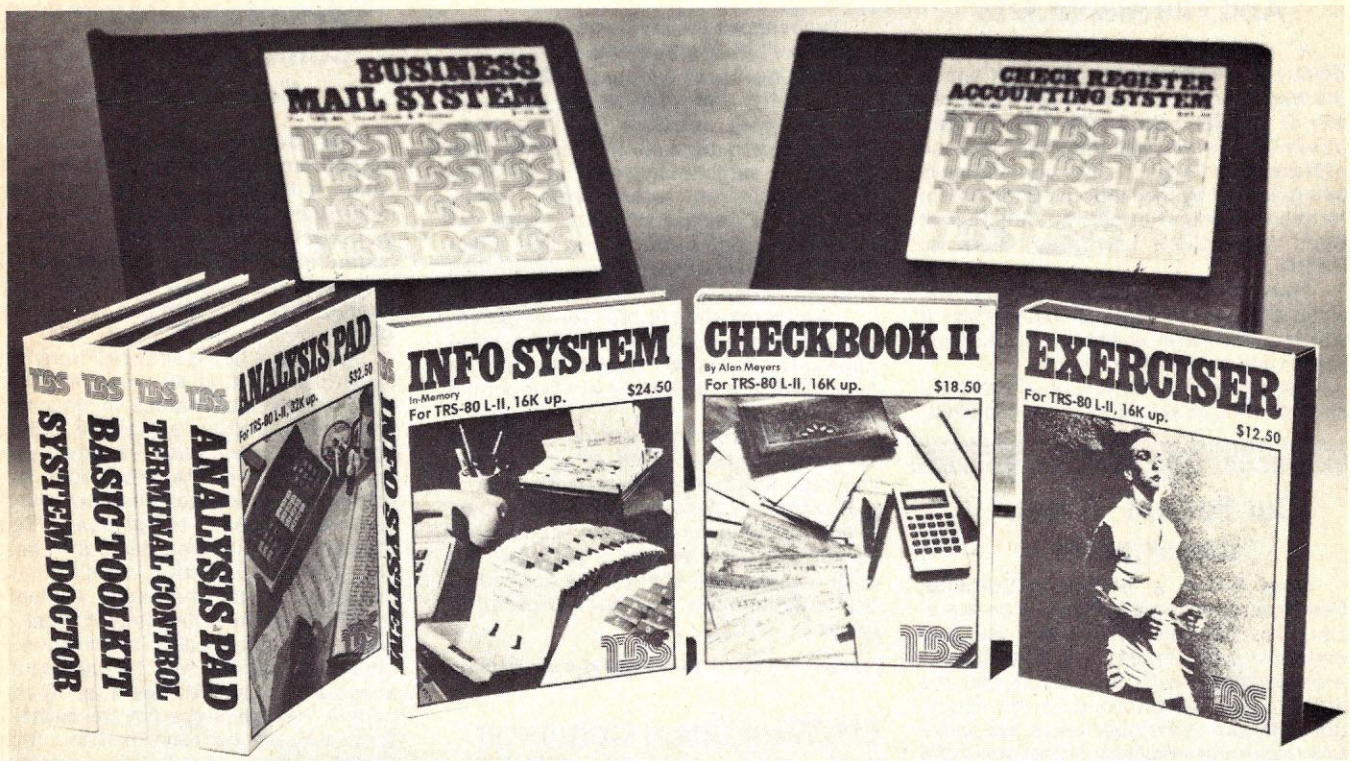

If you're not content with just playing games, **TBS** is producing applications software for your TRS-80 Level II that makes it a practical tool.

CHECKBOOK II by Alan Meyers is the finest program of its kind yet published. With superb graphic screen displays, it does everything necessary to keep your checkbook balanced. Data is input directly into a five-column screen display with a field for alpha or numeric codes. Editing is done easily in any or all columns. **CHECKBOOK II** will accurately balance and reconcile your checkbook, handling balances up to $1,000,000. Your balance brought forward is always in memory. Outstanding checks are listed and easily saved. You can also search for an entry by any field except amount, and all checks with matching entries will be displayed and totaled. A numeric sort routine is included. Screen prints can be made to a line printer from almost any point in the program. In addition, the 32-48K version can write files to disk. This and the 16K version are included on the same tape. For $18.50, **CHECKBOOK II** is the top of the line in personal checkbook programs.

INFORMATION SYSTEM by Dale Kubler is simply the best in-memory, data base manager on the market. It allows you to create files with up to ten categories per 'page', up to 40 characters per category and 200 characters total per page. Data from the keyboard is entered directly on a screen display of one entire page. Once entered, you can sort or search your entire data base by any category and have the information desired displayed on the screen. **INFORMATION SYSTEM** provides a thorough editing mode allowing changes by line without rewriting an entire file. Program your own printouts to almost any form you desire for line or serial printers. Screen prints from anywhere in the program are also available. **INFORMATION SYSTEM** creates either disk or cassette files depending on the version you use. Four versions are supplied with the program tape. From mail lists to recipes, for only $24.50, this program is the ideal information manager.

EXERCISER is for everyone. This program allows you to set your own physical fitness goals, then chart and analyze your progress toward these goals. Further, you may program an exercise regimen, then have the computer 'coach' you through your exercise routines. This system will allow you to use your computer to reinforce your effort to attain physical health. **EXERCISER** is really two programs in one. One measures your progress in jogging, swimming and bicycling and the other is for setting calisthenic regimens. It has long been known that to effectively structure an exercise program, it is necessary to think in terms of goals which can be met over a period of time. Whether you are training for the Boston Marathon or just wish for a minimum level of fitness, **EXERCISER** is designed to help you attain your goals. The price for this exceptional program is just $12.50.

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Electronic Technologies And The Media Arts

A conference entitled **Developing Electronic Technologies: Applications to the Media Arts** will be held at the University of Maryland Baltimore County campus in Catonsville, Maryland the weekend of **November 10 and 11.** The conference is being funded by the National Endowment for the Arts and is under the direction of Stan VanDerBeek and Fred Stern of UMBC.

The central focus is on computer and video systems for artistic expression. It will include panel sessions, workshop/demos and screening of works.

For more information or a brochure call Ann King at 301-455-2163 or 455-2150.

Our Face Is "Green" Department

Doug Green, a teacher in Cortland, New York, wrote us a fine article on evaluating teacher-generated tests. He was under the strong impression, as a result of a conversation with the editor, that his article would be included in the education-oriented September issue. He spoke to a group of several hundred teachers at a conference and told them to look for his article in the September issue. Well, the article didn't make it, for one reason or another. To make matters even worse, it didn't make it into the October issue, either. However, we've finally got it into this issue, Doug...and sincerely hope those people haven't questioned your honesty and integrity too much. — JTC

Many organizational changes are analogous to re-arranging the deck chairs aboard the Titanic.

Robert's Rules of Disorder

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For a **free** 20-page catalog of Creative Computing Software for all computers circle **224** on the reader service card.

Hopefully...

The response to my piece "To All Programmers" in the September issue was astonishing. Most people pointed out, a bit gleefully, that I was wrong in saying that the word affect is always a verb. Indeed, it can be a noun meaning "the conscious subjective aspect of an emotion considered apart from bodily changes." I hope this mistake did not obscure my point which was that affect and effect have quite different meanings and cannot be used interchangeably.

I was also called to task for my parenthetical and incorrect use of the word hopefully. It may be hoped that in the future I will not subject the word hopefully to such misuse.

Since interest in correct and effective usage of language both in writing and programming is high among both authors and readers, I have asked a well-known lexicologist to prepare an occasional column for **Creative** which will deal with both usage in general and as applied to the computer field. Look for it in a month or two. — DHA

5th West Coast Computer Faire Scheduled for Middle of March

The 5th West Coast Computer Faire will be held in San Francisco's Civic Auditorium & Brooks Hall, March 14-16, 1980. This is the site of the just-completed 4th Computer Faire, which had over 14,000 attendees — in spite of a major gas shortage — as well as more than 100 conference speakers, and over 330 exhibits.

Exhibit space is now available and is being rented on a first-come, first-served basis. Exhibitors in the just-finished Faire had first choice at space and have already contracted for more than 30% of the booths currently offered.

A call for papers and participation has been issued for the 5th Computer Faire. Speakers are sought to address all topics related to microcomputing, consumer computers, social impacts of computing and more. Proposals for talks should be sent as soon as possible. Author's kits will be sent to everyone proposing to speak, and completed, final papers and abstracts must be received by the Computer Faire no later than November 30th. Accepted presentations will be published in the **Conference Proceedings of the 5th West Coast Computer Faire.**

Exhibitor and speaker information may be requested from the Computer Faire, 333 Swett Road, Woodside, CA 94062, (415) 851-7075.

The Second National Educational Computing Conference (NECC/2) Call For Papers

The Second National Educational Computing Conference is aimed at providing a forum for discussion between individuals at all levels and from all institutions with interests in educational computing. This second conference will be held at the Holiday Inn, Downtown at Scope, Norfolk, Virginia, June 23-25, 1980.

Papers are being solicited from individuals representing all academic disciplines and research areas in educational computing. Authors are invited to submit papers describing actual experiences with computer use in the classroom or the consequences of such use upon the educational process in general. Papers should report concrete results or be of a survey or tutorial nature which include a synthesis and thorough evaluation. Papers must be submitted in final form with only modest editorial revisions possible. No papers will be conditionally accepted subject to rewriting. Accepted papers must be retyped by the author in a form suitable for reproduction. Special forms will be supplied at time of notification of acceptance. Copyright release is a necessary condition for acceptance of a paper. Deadline is January 15, 1980. Send papers to:

Professor Richard Austing
Computer Science Department
University of Maryland
College Park, Maryland 20742

Notification of acceptance will be around March 1, 1980.

Our Face Is Red Department

Introduction to BASIC, reviewed in the August issue of **Creative Computing**, is published by Digital Equipment Corporation, not Digital Press, and orders should be addressed:

Introduction to BASIC
AA-01551-TK
Software Distribution Center
Digital Equipment Corporation
Maynard, MA 01754

The article by Jim McClure in the September issue ("CBASIC - A Review") states that updates to CBASIC can be obtained from Software Systems, P.O. Box 145, Sierra Madre, CA 91024 for $5. The correct figure is $15. We apologize for the error.

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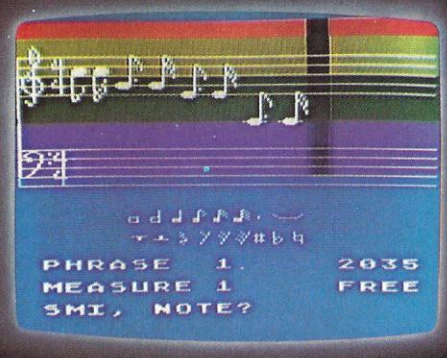

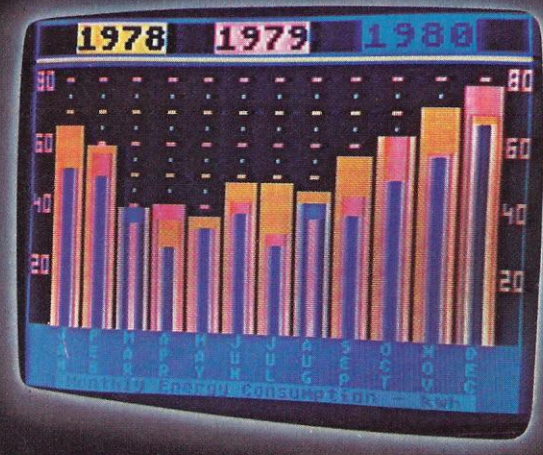

ATARI 400

ATARI 800

Compare the built-in features of leading microcomputers with the Atari personal computers. And go ahead, compare apples and oranges. Their most expensive against our least expensive: the ATARI® 400™.

Start with graphics capabilities. The ATARI 400 offers 128 color variations. 16 colors in 8 luminance levels. Plus 29 keystroke graphics symbols and 8 graphics modes. All controlled from a full 57 key ASCII keyboard. With upper and lower case. And the system is FCC approved with a built-in RF modulator. That's just for openers.

Now, compare sound capabilities. Four separate sound channels and a built-in speaker. With the optional audio/digital recorder, you can add Atari's unique Talk & Teach™ Educational System cassettes.

Here's the clincher: Solid state (ROM) software. For home management, business and entertainment. Or just plug in an Atari 10K BASIC or Assembler language cartridge and the full power of the computer is in your hands.

Memory? 8K expandable to 16K. And that's just for the ATARI 400 at a suggested retail of only $549.99.

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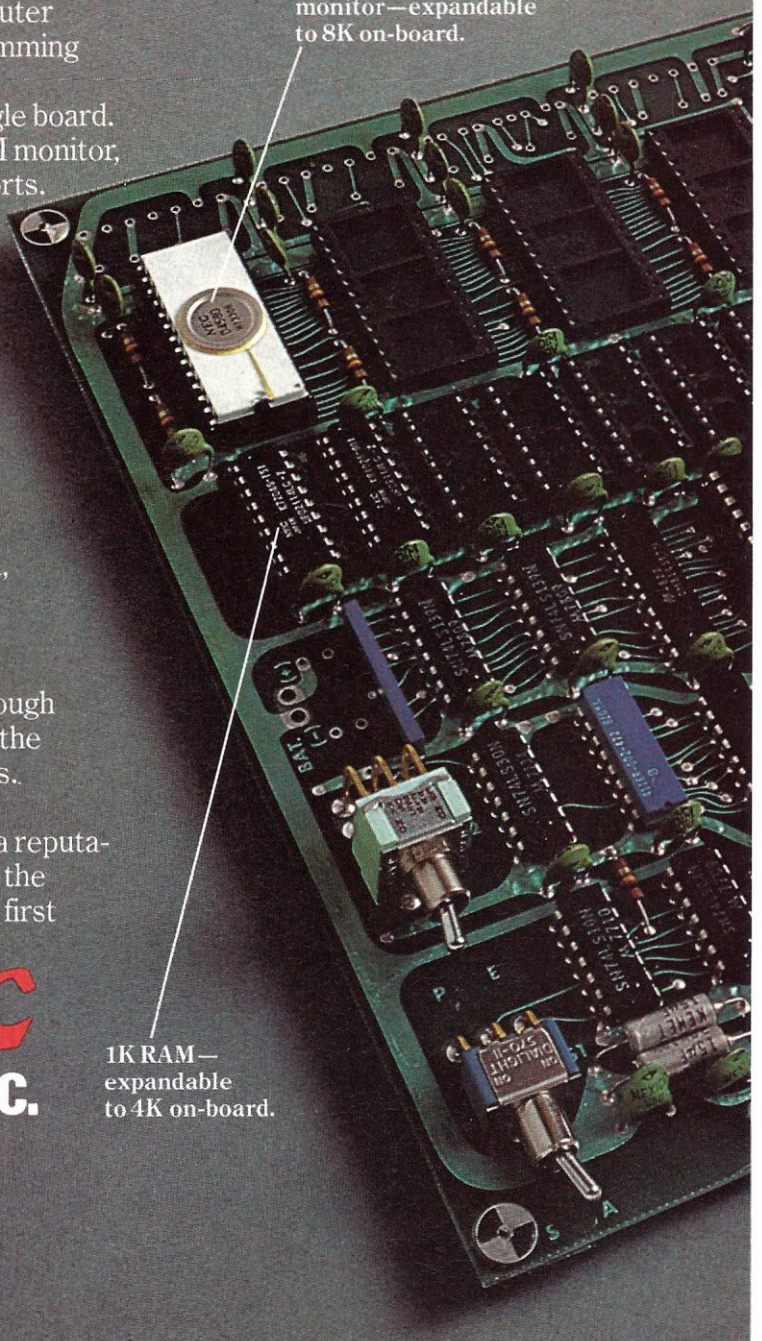

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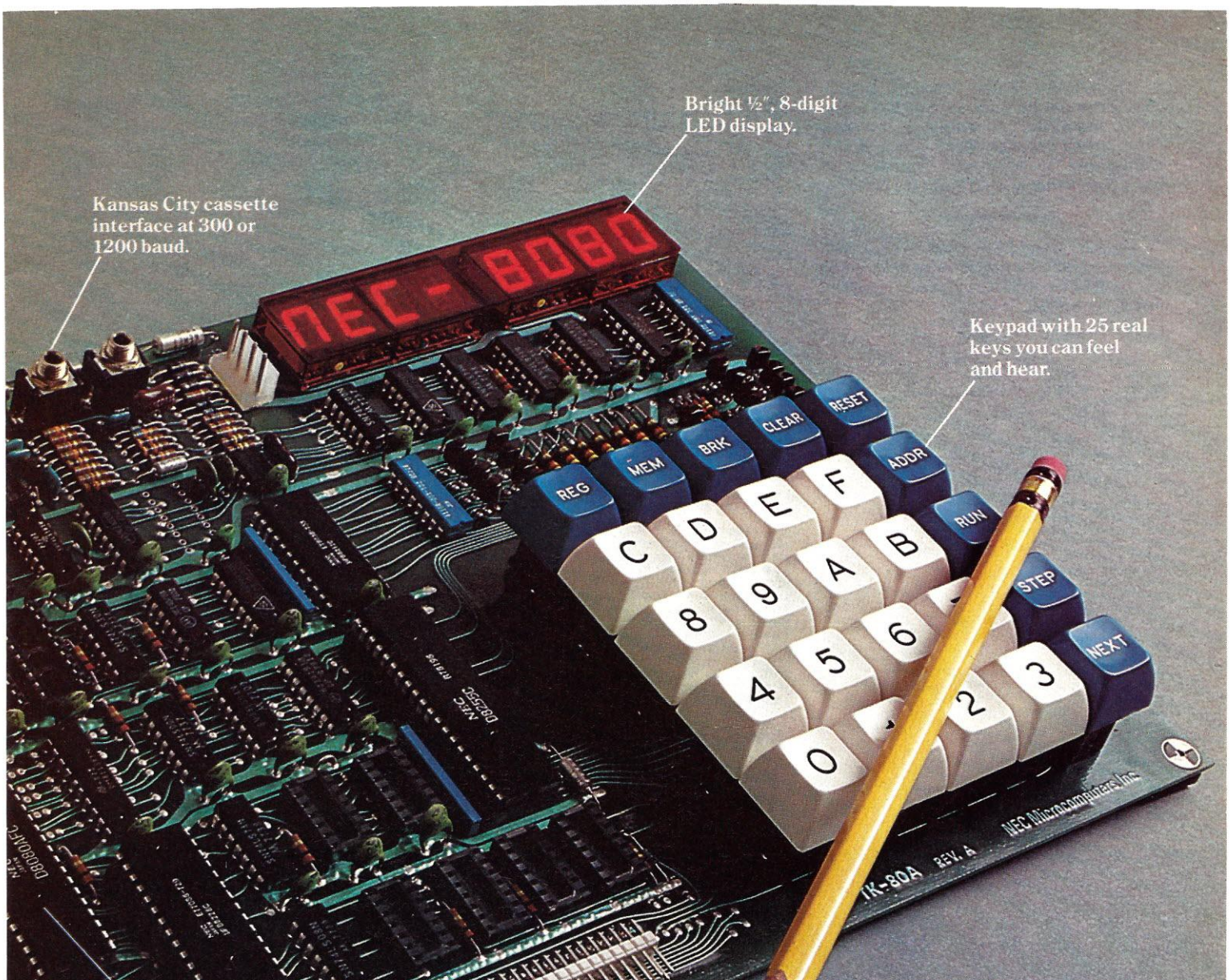

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In "Your Basic Binary Search: Simple Data Base Techniques In BASIC" (July, 1979), there are two errors in the flow chart. In the decision block with L & U it should say "L > = U?" The decision block below that should read "[F] > K?"

No, you don't have weak eyes. If you were searching for thatellusive program in our September PET column and couldn't find it, here it is:

Figure 1 - Better Cipher Program

```
10 PRINT"clr BETTER PET CIPHER PROGRAM
20 DIM M$(20),C$(20)
30 INPUT"dn dn ENCODE OR DECODE";A$
40 A$=LEFT$(A$,1)
50 IF A$="E" OR A$="D" THEN 70
60 GOTO 30
70 INPUT"CIPHERKEY";K$
75 KP=0:KL=LEN(K$)
80 IF A$="E" THEN 500
90 IF A$="D" THEN 1000

500 PRINT"clr ENTER YOUR MESSAGE TO ENCODE"
510 PRINT"dn 'EXIT' WHEN DONE dn dn"
520 FOR J=1 TO 20: M$(J)="": GOSUB 3000
530 IF B$="EXIT" THEN 550
540 M$(J)=B$: NEXT J
550 PT=1:PL=LEN(K$)
560 J=J-1
570 FOR S=1 TO J:C$(S)=""
580 FOR T=1 TO LEN(M$(S))
590 C$=MID$(M$(S),T,1):GOSUB 2000
600 C$(S)=C$(S)+C$
610 NEXT T
620 REM ADD NULLS
630 IF LEN(C$(S))-5*INT(LEN(C$(S))/5)=0 THEN 650
640 C$="sp":GOSUB 2000: C$(S)=C$(S)+C$: GOTO 630
650 NEXT S: REM DISPLAY CODE GROUPS
660 PRINT"clr CODE GROUPS:dn"
670 CG=0:DG=0
680 FOR S=1 TO J
690 CP=CG*5 + 1
700 PRINT MID$(C$(S),CP,5)" sp ";:DG=DG+1
710 IF DG>5 THEN PRINT: DG=0
720 CG=CG+1: IF 5*CG<LEN(C$(S)) THEN 690
730 CG=0: NEXT S
740 PRINT:PRINT"dn PRESS ANY KEY";
750 GET A$: IF A$="" THEN 750
760 GOTO 500
1000 PRINT"clr ENTER YOUR CODE GROUPS WITH A SPACE
1010 PRINT"BETWEEN EACH GROUP. 'EXIT' TO STOP. dn dn"
1020 FOR J=1 TO 20: C$(J)="": GOSUB 3000
1030 IF B$="EXIT" THEN 1060
1040 C$(J)=B$: NEXT J
1050 J=J-1
1060 FOR S=1 TO J: M$(S)=""
1070 CT=0: FORT =1 TO LEN(C$(S))
1080 CT=CT+1: IF CT>5 THEN CT=0: GOTO 1110
1090 C$=MID$(C$(S),T,1): GOSUB 2500
1100 M$(S)=M$(S)+C$
1110 NEXT T,S
1120 PRINT"clr YOUR MESSAGE: dn"
1130 FOR S = 1 TO J: PRINT M$(S): NEXT S
1140 PRINT"dn PRESS ANY KEY";
1150 GET A$: IFA$="" THEN 1150
1160 GOTO 1000

2000 IF C$="" THEN RETURN
2010 KP=KP+1: IF KP>KL THEN KP=1
2020 K=ASC(MID$(K$,KP))+ASC(C$)-64
2030 IF K>95 THEN K=K-64
2040 IF K< 32 THEN K=K+64
2050 C$=CHR$(K): RETURN

2500 IF C$="" THEN RETURN
2510 KP=KP+1: IF KP>KL THEN KP=1
2520 K=ASC(C$)-ASC(MID$(K$,KP))+64
2530 IF K< 32 THEN K=K+64
2540 IF K>95 THEN K=K-64
2550 C$=CHR$(K): RETURN

3000 PRINT"\";:B$="":Q$=CHR$(34)
3010 GET A$: IF A$<>"" THEN 3100
3020 FOR Z=1TO20:NEXT:PRINT"rvs v lft";      (Shift-V)
3030 FOR Z=1TO20:NEXT:ORINT"off sp lft";
3040 GOTO 3010
3100 IF ASC(A$)=13 THEN PRINT: RETURN
3110 IF A$<>CHR$(20) THEN 3160
3120 IF B$="" THEN 3160
3130 IF LEN(B$)=1 THEN B$=""
3140 IF LEN(B$)> 1 THEN B$=LEFT$(B$,LEN(B$)-1)
3150 PRINT A$;
3160 IF A$=Q$ THEN PRINT Q$CHR$(20);
3170 IF A$<"sp" OR A$>"←" THEN 3010
3180 B$= B$+A$:PRINTA$;:GOTO 3010
```

The only sure thing about luck is that it will change.

Later yet, here's Al Weiss' Deck Shuffling from October's I/O:

```
100 DIM I(52),D(52,2)
110 REM
120 REM: ORIGINAL
130 REM: STATEMENTS
140 REM:                          TEST STATEMENTS
150 REM
160                               K1=99999
170                               K2=0
180                               FOR T=1 TO 1000
190 REM: SHUFFLE
200 FOR I=1 TO 52
210 I(I)=0
220 NEXT I
230                               K=0
240 FOR I=1 TO 52
250 J=INT(52*RND)+1
260                               K=K+1
270 IF I(J)<>0 GOTO 250
280 D(I,1)=INT((J-1)/13)+1
290 D(I,2)=J-13*INT((J-1)/13)
300 I(I)=1
310 NEXT I
320                               K0=K0+K
330                               IF K>=K1 GOTO 350
340                               K1=K
350                               IF K<=K2 GOTO 370
360                               K2=K
370                               NEXT T
380                               PRINT "MIN";K1
390                               PRINT "MAX";K2
400                               PRINT "AVG";K0/1000
410                               END

RUN
MIN 102
MAX 688
AVG 237.874
```

NOW THE SHORT WAY...

```
100 DIM I(52,2),D(52,2)
110 REM: SHUFFLE
120 K=0                           210 FOR I=1 TO 52
130 FOR I=1 TO 13                 220 J=INT(K*RND)+1
140 FOR J=1 TO 4                  230 D(I,1)=I(J,1)
150 K=K+1                         240 D(I,2)=I(J,2)
160 I(K,1)=I                      250 I(J,1)=I(K,1)
170 I(K,2)=J                      260 I(J,2)=I(K,2)
180 NEXT J                        270 K=K-1
190 NEXT I                        280 NEXT I
200 K=52                          290 END
```


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CIRCLE 183 ON READER SERVICE CARD

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Sonja Richman – Age 9

Sonja used Program Design educational software on her TRS-80. PDI programs and games teach subjects like programming, reading, and grammar. Kids and adults like PDI because the programs keep them involved and entertained while they learn.

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NOVEMBER 1979

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Electronic Games Roundup

David Ahl and Betsy Staples

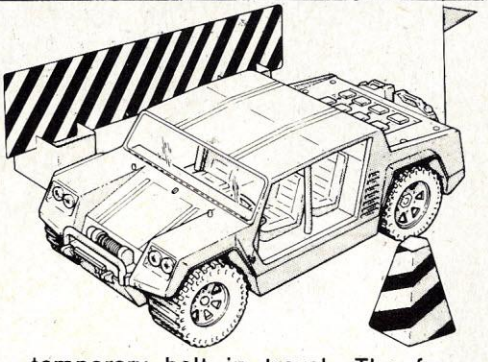
Around July, all the games that we saw at the Toy Fair back in February begin to arrive on dealer's shelves. They also begin to arrive in our office. Equipping ourselves one night with a carton of these games and a large supply of batteries we set off to do some evaluations. The reviews below are a combination of our comments and the comments of children in the recommended age ranges playing the games.

One note about batteries, if you buy several electronic games this holiday season you can expect that the batteries they require will probably not be the same — the games in our test took everything from six AA's to three C's, plus a 9-volt battery and all combinations in between. Furthermore, most of the manufacturers recommend longer life alkaline or high energy batteries which cost anywhere from 3 to 10 times as much as the regular ones. If you are really into electronic games you may well wish to consider investing in a battery eliminator (cost around $5). In a few months of play you'll easily use this much in disposable batteries.

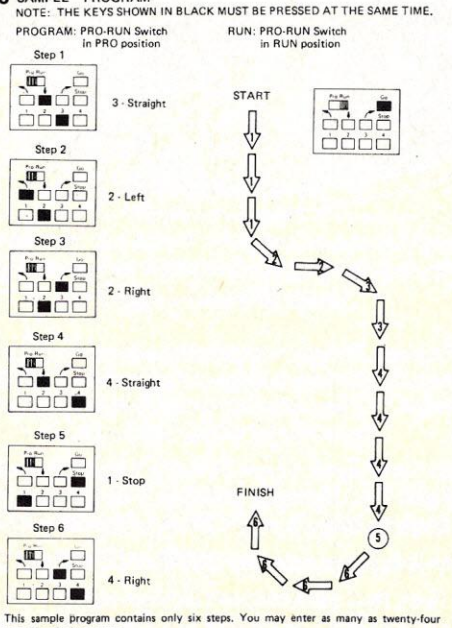
Not all of the games that we reviewed were strictly electronic games. We've tried to look at a representative cross section of electronic, electric action and even manual games that are new, interesting and challenging. Clearly, there are scores of others on the market that are not reviewed, but from these reviews you should get a good idea of the kind of action and sophistication you'll find in this year's crop of games.

Brain Buggy by Fun Dimensions

Brain Buggy is a ruggedly-built motorized, off-road stylized vehicle that can be programmed by the user. Eight keys are used to enter up to a 24-step program. Each program step is programmed with two keys: TDU (Time/Distance Unit) and Directional Command. One "TDU" represents approximately one-half second of travel in a particular direction or a

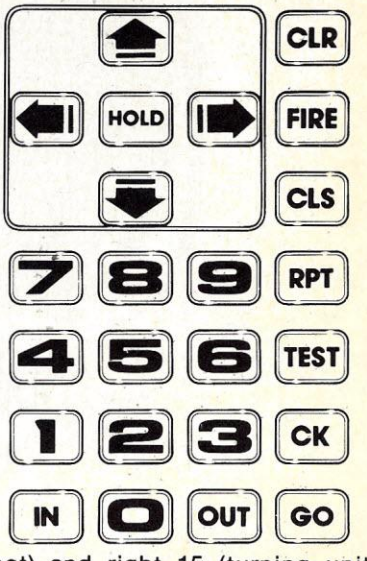


temporary halt in travel. The four directional commands are right turn, left turn, straight ahead, or stop. The nature of the "language" is very similar to LOGO and we found that young children (ages 6 and 7) could use Brain Buggy with very little instruction. (The manufacturer recommends the toy for age 8 and up.) Setting up an obstacle course and programming Brain Buggy to negotiate it we feel is an excellent introduction to computer programming at a low level. At $26.95 we feel Brain Buggy is one of the best new toys on the market this year.


3 SAMPLE PROGRAM
NOTE: THE KEYS SHOWN IN BLACK MUST BE PRESSED AT THE SAME TIME.
PROGRAM: PRO-RUN Switch in PRO position
RUN: PRO-RUN Switch in RUN position
Step 1
3 - Straight
Step 2
2 - Left
Step 3
2 - Right
Step 4
4 - Straight
Step 5
1 - Stop
Step 6
4 - Right
START
FINISH
This sample program contains only six steps. You may enter as many as twenty-four steps in a single program.
The same program may be run over and over again, by simply pushing the GO Key. Moving the PRO-RUN Switch or turning off the main power switch erases the program.

Big Trak by Milton Bradley

No question, it's big — 13" long x 9" wide x 6" high. And it needs 4 C-cells and a 9-volt battery to run. Like Brain Buggy, it can be programmed to go forward, turn right or left, halt, and also go backward. It fires a "photon beam" (light and sound) against an enemy, or sleeping cat for that matter. Big Trak permits units of movement up to 99, say forward 99 (distance units are approx.



1 foot) and right 15 (turning units correspond roughly with minutes on a clock — right 15 is a 90° turn). The maximum command sequence (program steps) of Big Trak is 16 (compared to Brain Buggy's 24), but Big Trak has a repeat command which, if used as the 16th command, may repeat the previous 15 steps. Repeat may be used only once in a program, an unfortunate limitation in our opinion, since it prevents a child really grasping the notion of a subroutine. Wouldn't it be nice if a child could command Big Trak:

Forward 1, Right 15
Repeat last 2 steps
Repeat last 2 steps
Repeat last 2 steps

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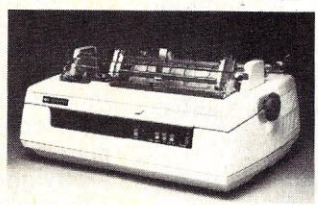

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and have a square traced out. Just like LOGO, but alas it is not to be (at least not this year).

Big Trak plays a cute tune at the start and end of executing a command sequence and signals you to shut it off if you ignore it for more than 30 seconds. A nice rugged toy at a somewhat rugged price of around $43. The trailer wasn't available at the time of testing — it hitches to Big Trak and dumps its load for another $20 or so.

Kids loved both Big Trak and Brain Buggy — you will too. Recommended.

Computer Perfection from Lakeside

One of the most heavily promoted games of this season, Computer Perfection, is attractive and well designed, but proved to be an enigma to our panel of users. For some kids, it was their favorite game; other people found it extremely frustrating. The game turns on when the translucent blue dome cover is rolled back. It has two solitaire games, and two for two players. All games may be played at any of three skill levels.

The object of most of the games is to light all 10 lights (arranged in an 8" sphere) in the proper order with the least number of moves. As you press one of the 10 buttons, also in a circle, one of the lights will flash on and off. By a combination of trial-and-error and deduction you must light all the lights in sequence. Game 2 has the same object except if you make a mistake, you start over. In the two player games, each player tries to light his or her half circle of 5 lights. Delay more than 12 seconds and you lose a point or a turn. Forget to close the lid after you finish playing and the game sounds a warning signal, a nice battery-saving feature.

Maniac by Ideal

Maniac is designed for two to four players ages eight and up, and consists of "four totally different electronic challenges, each ingeniously designed to test your reflexes, speed and accuracy." Maniac has four paddles surrounding a LED display. The first challenge is Musical Maniac in which Maniac plays a series of random tones accompanied by a flashing pattern. Players race to press their paddles as soon as the beeps stop. In another challenge, Look Twice, Maniac creates a pattern in light. Next, three more random patterns, one of which may or may not be the same as the original are displayed. Players press the paddle when the original pattern is repeated or after the third pattern disappears if the original pattern is not repeated. The remaining challenges are similar combinations of light and sound.

After each round, Maniac displays each player's cumulative score; the first player to accumulate 25 points wins. We found that each of us had a favorite challenge at which he or she was particularly successful and at least one which he or she found very difficult. The difficult ones became very frustrating after awhile. Maniac was fun for a while, but as primarily a game of reflexes, not one of our favorites for long term enjoyment.

Zodiac by Coleco

If you're the type who picks up the newspaper and immediately turns to the horoscope column to see what the stars have in store, you'll probably be fascinated by Coleco's Zodiac, the Astrology Computer.

The computer itself, contained in a round plastic case with keys and an LED display on top, must be used in conjunction with the 80-page manual which provides detailed instructions and interpretations. Using Zodiac, one can cast a horoscope, plot a preview of a future date, or ask advice regarding one's activities in any of 96 subject areas.

We did our own horoscopes and found that of the 15 or 20 descriptive statements in each, several were general enough that they could apply to just about anyone and a couple were completely inaccurate, but the majority, taken together, provided a pretty good analysis of the subject's personality. That one of us was "unorthodox, anti-establishment and impatient at times," for example, came as no surprise, but we had a hard time taking seriously the assertion that the other "wants to rule by 'divine right.'" The preview and advice modes were much more general, and, hence, more difficult to test.

Coleco reminds us throughout the manual, "Astrology guides—it does not rule!" And there are probably better ways to plan your life, but Zodiac is entertaining, and might be an interesting guest at your next party.

Astro by Kosmos

Astro is a hand-held "computer" which can provide a natal horoscope, an estimate of astrological compatibility for any two people, or a daily horoscope. In its more pragmatic moments it serves as a four-function calculator.

To obtain personal horoscope information, the user need only key in the date of birth. Astro's display then flickers for a moment or two and prints out four sets of code numbers which indicate the position of the

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IQ 140

SOROC's first and foremost concern, to design outstanding remote video displays, has resulted in the development of the IQ 140. This unit reflects exquisite appearance and performance capabilities unequaled by others on the market.

With the IQ 140, the operator is given full command over data being processed by means of a wide variety of edit, video, and mode control keys, etc.

The detachable keyboard, with its complement of 117 keys, is logically arranged into 6 sections plus main keyboard to aid in the overall convenience of operation. For example, a group of 8 keys for cursor control / 14 keys accommodate numeric entry / 16 special function keys allow access to 32 pre-programmed commands / 8 keys make up the extensive edit and clear section / 8 keys for video set up and mode control / and 8 keys control message and print.

Two Polling options available: 1) Polling compatible with Lear Siegler's ADM-2. 2) Polling discipline compatible with Burroughs.

IQ 120

The SOROC IQ 120 is the result of an industry-wide demand for a capable remote video display terminal which provides a multiple of features at a low affordable price. The IQ 120 terminal is a simple self-contained, operator / computer unit.

The IQ 120 offers such features as: 1920 character screen memory, lower case, RS232C extension, switch selectable transmission rates from 75 to 19,200 bps, cursor control, addressable cursor, erase functions and protect mode. Expansion options presently available are: block mode and hard copy capability with printer interface. The IQ 120 terminal incorporates a 12-inch, CRT formatted to display 24 lines with 80 characters per line.

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Sun, Mercury, Venus and Mars on the day of birth. A quick check of the accompanying handbook reveals the significance of these locations in determining the personality of the subject.

The second mode of operation allows one to "determine the compatibility between any two people" by entering both birth dates and then checking a series of four lights on Astro's dial: green lights indicate personality traits which are similar, yellow lights those which are different. Using the handbook, the user may then proceed to an in-depth personal compatibility analysis which answers 16 questions such as "Do you enjoy or appreciate the way I think?"

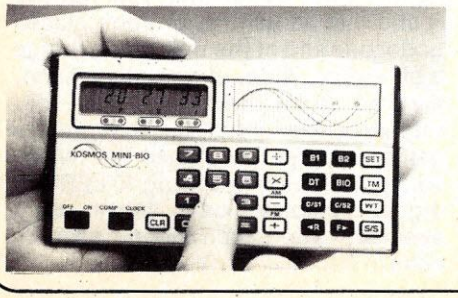
A third use of Astro is to determine a daily horoscope. Again, yellow and green lights indicate similarities and differences between the prevailing influences and the subject's personality traits.

While not nearly as detailed or complete as Zodiac, Astro does provide a list of references from which one can learn more about astrology and, presumably, make more complete use of the information provided by the computer. It is also much more compact and quieter than Zodiac.

Mini-bio by Kosmos

Mini-bio is a tiny (2½" x 4¾" x ¼") calculator/computer designed to provide the user with personal biorhthym data. Entering the date for which the information is desired and the subject's date of birth causes three numbers representing days in the physical, emotional and intellectual cycles to appear on the display.

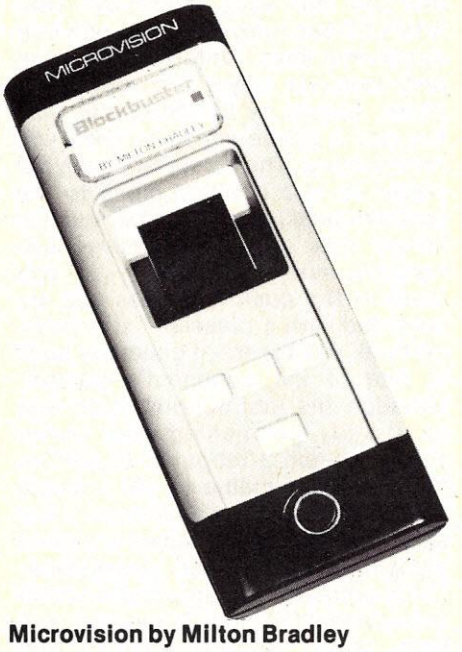
By referring to the manual (which is larger than the calculator and offers instructions in four languages), the user can determine whether the day is "clear," one on which caution or "mini-caution" should be exercised, or a "recharge period" for each of the cycles.



Mini-bio will also compute the "average lifetime compatibility/similarity ratios" for any two people, or daily compatibility/similarity ratios. We checked the ratios for one happily married couple we know and discovered that they should probably never have gone on their first date—but then Kosmos assumes no responsibility for decisions made based on the information obtained from Mini-bio.

We were unable to set the clock included in the little machine, so are unable to comment on its accuracy, but, assuming the clock can be set for the correct time, a quick look at a map on the back of the case gives the user a code which can be used to find out the time anywhere in the world. The stopwatch function worked nicely, as did the four-function calculator.

Astro and Mini-bio, at $49.95 and $79.95 respectively, are clever gadgets, but whether they are worth the price depends on how much one values the information they provide.



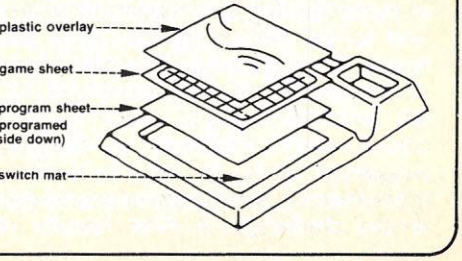
Microvision by Milton Bradley

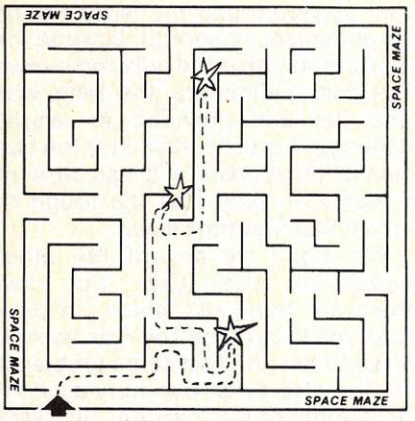
This hand-held simulated video game has a 16x16 pixel LCD display about 1.4" square. The game is supplied with Blockbuster, M-B's version of Breakout. A small knob at the bottom moves the paddle back and forth across the bottom of the display to hit the ball. At the beginning, you select 1, 3, 5, 7, or 9 balls, slow or fast speed (most players found "slow" to be more than challenging), and paddle size (again, most players found the large paddle size enough of a handful). Despite the small display size and only three rows of blocks to eliminate, the game was good fun and provided an ample challenge. Actually, if you hit the ball when it first appears, it's less difficult to keep it in play, but it's tough to catch it that first time down.

We didn't try any of the other Microvision cartridges, but five others are promised which, in their prototype form at the Toy Fair, looked like good fun. We had some problems with the display on our early production sample of Microvision, but were assured by M-B that the problem was cured in units released to stores and that they were guaranteed also. This sounds okay, but our advice would still be to play it if possible before taking it home.

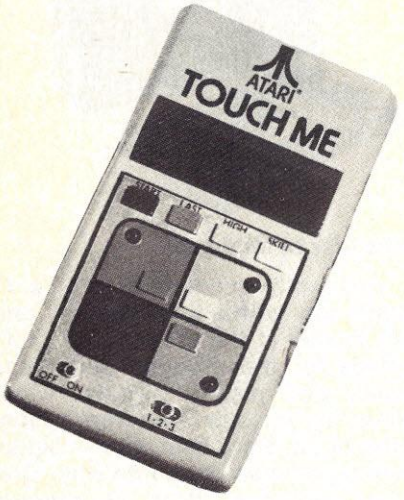
Astro War by Mini Labs

Astro War consists of a 5" x 7" plastic tray with a 9 volt battery and LED flasher at the top and a 4" x 4" surface for the program and game sheets and plastic overlay. Eight games are included — target probe, space maze, black hole, etc. — but all are programmed the same way. One player blackens 10 to 15 random squares on the program sheet. This is placed face down on the conducting grid mat with a game sheet and plastic overlay to write on placed on top (see diagram). Players then take turns trying to find their way through a maze, out of a black hole, or





between two star bases without lighting the Astro Flash. Lighting the flash means different things in each game and can sometimes hinder, sometimes help the player. One minor problem was having to erase the overlay after each game — be sure you have a large eraser on hand. Nevertheless, we found the game a pleasant change from the scores of preprogrammed hand-held games. Recommended for age 8 and up.



Touch Me by Atari

This compact hand-held game (3"x5"x0.8") is modeled on last year's huge success, Simon, which was, of course, modeled on Atari's coin-operated game of Touch Me. Touch Me plays three variations of the game of remembering and repeating longer and longer sequences of lights and tones. Each game has four skill levels corresponding to sequences of 8, 16, 32, and 99 signals. Most players could easily remember an 8-signal sequence; rarely did anyone achieve more than 32, so this game possesses ample challenge. A nice feature is that Touch Me records the highest score during one powering up of the game; players can use this to try to beat the best record among a group of friends. In the second variation, players each add one to the sequence of signals, while the third variation is an elimination type of game for two, three or four players.

Soccer by Mattel

There is no way you can figure out this game without instructions. And even after reading the instructions this one isn't easy. You move your little LED blip/player around with four directional keys. Unfortunately, you only have one player and your opposition, played by the computer, has five and a goalie which to keep you from scoring. The object is to get your player up to a position close to the goal and press the "kick" key quickly before one of the defensives can respond, and hope that your ball lands in the goal. If it does you are rewarded with a pleasant little musical tune, if it doesn't it generally goes to one of the opponent's players, although the instructions state that by cleverly positioning your player you can catch a rebound. In half an hour we were unable to get a single rebound except by dumb luck. After each play the referee blows a whistle signalling loss of ball possession. There are also clicking noises which indicate that the clock is running, and beep tones, double whistles and triple whistles all with their own meanings. A cute game, but not nearly as absorbing as baseball or some of the other Mattel games we reviewed last season and that are still on the market.

Computer Bowling by Vanity Fair

Speaking of games of reflex and eye/hand coordination, another example is Computer Bowling. In this nice, large game (15" x 6" x 3"), an illuminated LED "ball" oscillates back and forth across the end of the alley. At any point, it may be released by pressing the large release bar. Sequentially illuminated LED's show the travel of the ball down the alley. As pins are hit, the lights go out. Releasing the bar controls the degree of hook or slice. Sound effects simulate a rolling ball and pins falling down. Ten frames may be rolled either solo or against an opponent with standard scores being displayed. To win, a good eye is more helpful than logic or strategy.

Foto-Electronic Bowling by Cadaco

This larger-than-average game (15 x 4.5 x 3") combines electronics and physical action. To play, you aim and then strike (hard) a plastic handle (1 x 2.7") at the bottom of the game. This propels a steel ball toward the "pins," represented by 10 LED's, at the end of the alley. LED's go out showing which, if any, pins were toppled. A digital scoring mechanism keeps score for one or two players. A beep registers for each pin felled while ends of frames, spares, strikes, and misses each have their own distinctive melodies. Some players objected to the force needed to strike the handle and launch the ball but we found that an ashtray or book placed under one end of the unit made things a bit easier. Kids, on the other hand, liked to strike the handle with four fingers or even a fist and thought the game was just fine. Since the two 9-volt batteries are powering 10 LED's, a digital display and fairly loud speaker, we recommend alkaline cells.

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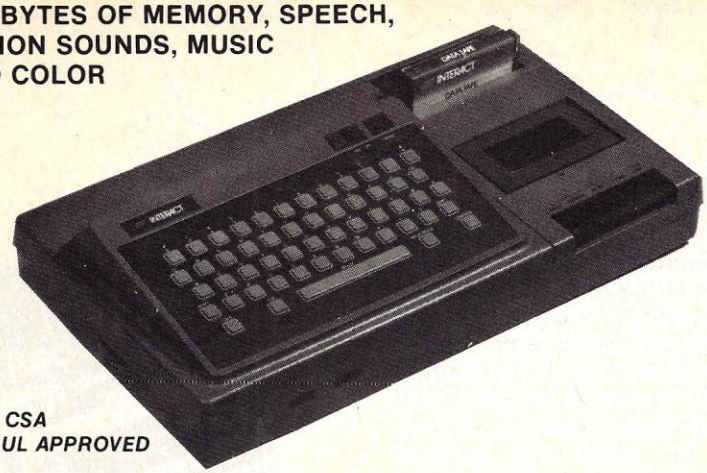

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Beneath its cover is the Intel 8080® microprocessor brain—a powerful logic component used in computers costing tens of thousands of dollars. Interact loads data up to 5 times faster than most other compacts. Its 8080 brain does all of the complex data saving, processing and retrieval chores. All that's left is typing in the data through the 9 inch, 53-key standard typewriter keyboard.

WHY IT COSTS LESS

Since the unit performs in **color,** it is designed to hook up to any TV antenna terminal. If we included a color screen (CRT), we'd have to charge more. Witness the 16K Radio Shack Model. It's only black and white, and with its screen that isn't even a TV, it costs $899.00. Ours, with full sound and color is several hundred dollars less. Interact **full sound** is generated three ways: There are game action sounds from the microprocessor, tunes within the programs and actual speech and music from any cassette software. *In fact, it is the only computer able to transmit full sound through a TV.* **Image resolution** is superb.

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Since it can talk, play music and perform in color, Interact is a phenomenal teacher. That's why High/Scope, an educational research foundation, was commissioned to develop an exclusive Language Arts program for it. The 8-unit program ranges from Letter Recognition for preschoolers through Word Root, Grammar, Critical Reading and Writing exercises for the 8 to 15 year old. Students listen, take notes and prepare assignments through the computer. Similar math and foreign language programs are also being prepared. By comparison, *any one of these courses given by a tutor or commercial school could easily cost as much as the computer itself.*

IT'S A BRILLIANT MUSIC TEACHER

A comprehensive music program and a piano keyboard overlay turn the computer into a perfect pitch maestro. You can practice, write a tune or record. To create a melody, you can select both key and tempo. A staff is displayed on which to write your song, note by note, complete with rests and values. Play the composition back; correct any note; instantly transpose it to another key; or store it on a blank cassette for later revision. A student can listen to his lesson and transpose it into another key for use with F, B^b, E^b horns, etc. The youngster then plays along in the right key, in the correct meter. *It's a fantastic application.*

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Interact is a total entertainment center with color, sound, and music. There are Chess, Backgammon, Hangman, Regatta Races, Concentration, Trailblazers, Blackjack, Star Track—games that would cost any arcade owner $2000 or more. Challenge the computer or another opponent. Each game will bring family and friends together for hours of quality fun.

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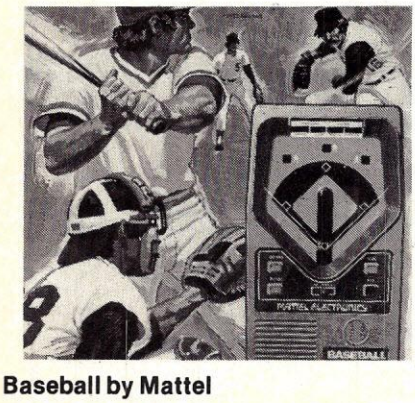
Pulsonic Baseball II from Mego

One of the favorites of our panel of kids, this one- or two-player game is stylized in molded plastic like a miniature baseball stadium. One player pitches to the other by pressing one of four pitch buttons at the top of the unit. With a fast ball, he may press a "change-up" button to convert the pitch from fast to slow. The other player presses the "batter" button just as the LED ball enters the strike zone. If the batter connects, the LED ball bounces around the field and finally comes to rest as a catch by one of the fielders, a foul ball, or a hit. When the batter has runners on first and third, he may try to steal, but timing is critical to execute this play without being thrown out. The game keeps track of strikes, balls, outs, and the score. A cute little tune is played after each play or when teams change sides. With just one player, the game takes the role of the fielders and lets the player always be the team at bat.



Baseball by Mattel

There is no question that baseball is the all-American electronics sport this year (eleven manufacturers). Of the many, Mattel's is one of the best. In this electronic game, when you are up to bat you press the "pitch" key and 1.5 to 2.5 seconds later a moving LED "ball" comes from the pitcher's mound toward the batter. When it reaches the strike zone you press the "hit" key and hope for a good hit. You can either fly out, hit to some point in the field or hit a home run. If you hit to the field, the beeper in the game will indicate how many bases you can try to run — but watch out, because sometimes the fielder will be faster than your runners and will throw you out. You've got to be fast on the keys. If you hold down the run key just a bit too long you overshoot a base and are almost always thrown out. At the end of each half inning you press the "score" key to see the score—visitors vs. home team. This is the time to pass the game to your opponent or, if you are playing both sides, to start playing the opposite team. Mattel, recognizing that nine innings is a long time to hold one's interest has made this into a five inning game. At the end of the five innings the final score lights up and the game becomes inactive until you switch to the off position and back to one of the two skill levels. Uses one 9-volt battery.

MVP Baseball, Football, and Basket-Basketball

Of the three games, baseball was by far the best. In it, the fielder "pitches" the ball to the player who is at bat. Upon pressing the "pitch" button a slot machine type mechanism spins. The batter then presses either the "bat" or "take" button. The wheels stop spinning and the game reveals the effect that the batter had on the ball. That is, a ball, strike or hit. If the batter hit the ball, the fielder then presses the "field" button and tries to make an out. We found that 19 times out of 20 he was successful. On the other time an error was committed. The batter, if he has a player on one of the bases, may also elect a steal. Stealing is successful about 50% of the time. A record of strikes, balls and outs may be kept on little plastic dials on the side of the game. A record of runs must be kept with pencil and paper on the score card provided with the game. All in all, not a bad game for the money.

We found Football considerably more complex to play. The general playing mechanism was the same with the little windows showing the results of each play. But you have to keep track of which results applied to a running play and which applied to a passing play. Your own imagination is probably the greatest asset in making football an interesting and fun game.

Basketball is entirely different. Each player has five buttons to press

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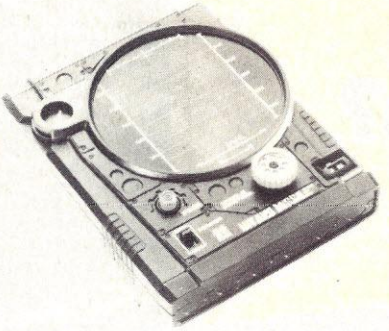
to propel a little plastic ball up toward a basket. If it goes through the basket it strikes an arm that registers two points on the score board and makes a squeak reminiscent of the baby dolls of 20 years ago. The first player to score 30 points wins. Basketball and pinball are probably best suited to children 5 to 8, baseball up to 10 years of age and football up to 13 or 14.

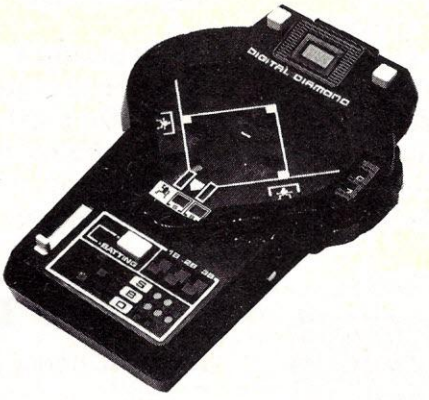
Intercept by Lakeside

Intercept is described as "an electronic search and destroy game with the sounds and lights of fighter attack." Indeed it does have sound and light — mostly sound. Two players are pitted against each other on a 10 by 20 grid. One player tries to move his attack jet from one end of the grid to the air field target at the other end. The other player is armed with four SAM missile bases, which can be placed at various strategic locations on the grid, and an interceptor to locate the attack jet. The player on the attack moves his attack jet four spaces horizontally or vertically with each move, and the interceptor must try to pinpoint his location. The main use of electronics in this game is to light up the location of the attack jet or the interceptor after each move, and to make a siren-like noise when the interceptor locates the attack jet. In addition there is a constant clock ticking as the game goes on. This is hardly what one would call an "intelligent" electronic game. However, youngsters will probably enjoy it as they do many of the other combination action/strategic games on the market today. (Hint: One particularly aggressive player found that the SAM missiles can be positioned to always allow a win on the first move.)



Hit and Missile from Tomy

Not an electronic game per se, Hit and Missile is a battery action game of "pursuit and shoot." Randomly spaced aircraft pass across the top of the screen in two directions. You move your missile launcher back and forth across the bottom of the screen and press the "fire button" to launch a missile. A hit produces a flashing light and "explosion" sound effect. Your score is recorded on a readout in the lower left corner of the game. Each game lasts one minute. Ruggedly designed, this game seems to hold the attention of 6 to 10 year olds.

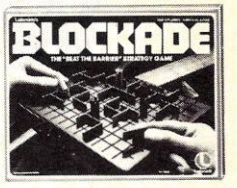


Digital Diamond from Tomy

This is a two-player baseball game. One player presses a button to "pitch" the ball. The other player tries to bat it with his button. If he connects, a slot-machine type dial spins to show the outcome (out, single, double, etc.). Keeping track of strikes, balls, outs, score, and runners on the field is all done manually with little plastic dials and levers. If it sounds like a bit of a bore, it is. On the other hand, it's cheaper than the electronic games and it's well constructed.

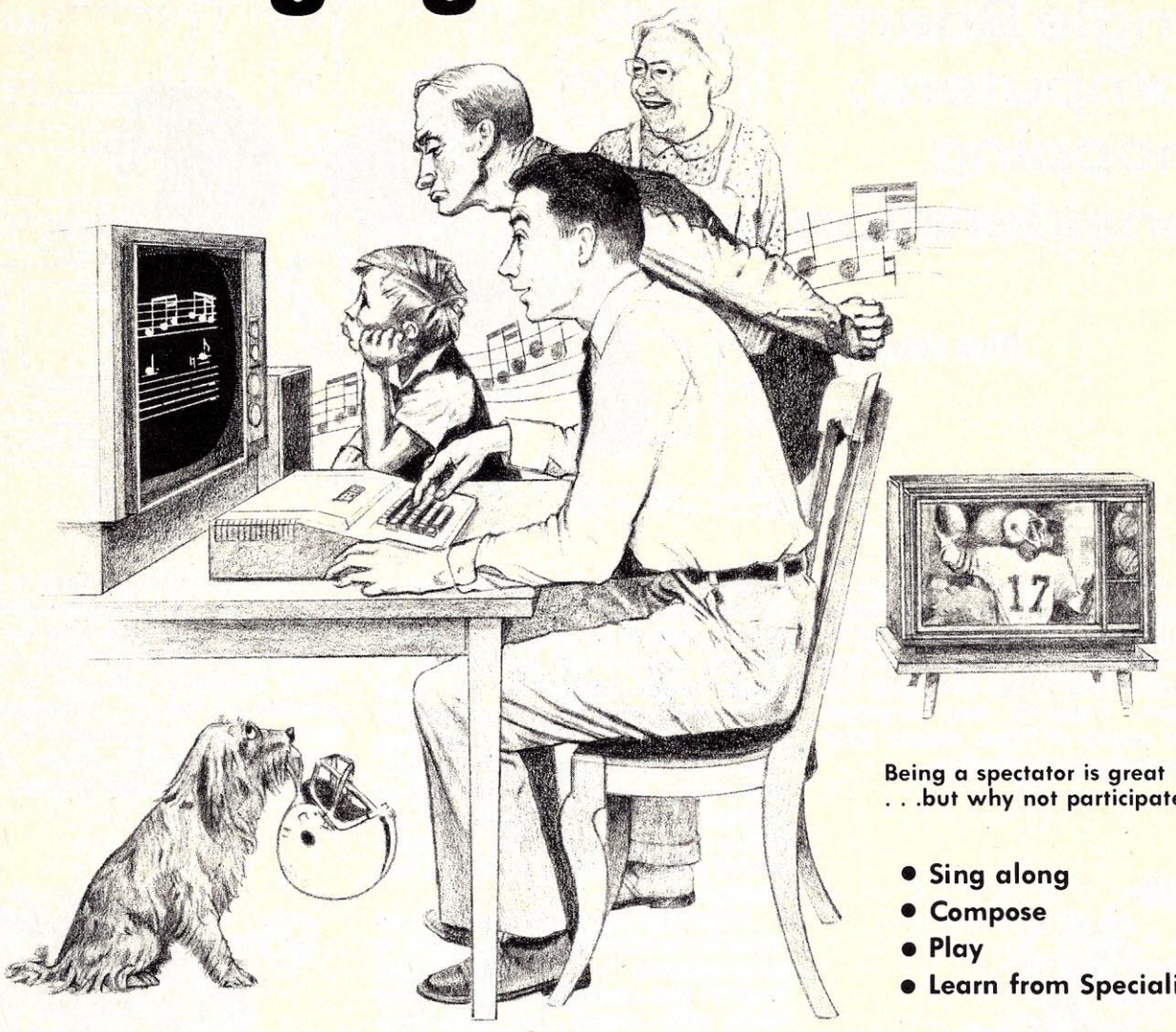
Blockade and Score Four by Lakeside

Blockade is a non-electronic strategy game for two people. Players move their two "pawns" across a grid in an attempt to capture the opponent's "home" square. After each move, the player places a barrier on the grid creating a network of walls to block the other player's advance — but there must always be at least one open pathway, no matter how convoluted. The first one to make it through the maze wins.



Score Four is a "four in a row strategy game in three dimensions." The playing area consists of 16 plastic spindles set vertically in a plastic tray. Players attempt to score by placing four beads in a row horizontally, vertically or diagonally. The first one is easy, but that's only one quarter of the game: the winner is the player who scores four times. Planning your strategy while keeping track of your opponent's beads in three dimensions can be quite tricky. We saw one game in which the winner was not determined until the last of the 64 beads was placed. Although less novel than some of the electronic games we tested, Blockade and Score Four are intriguing games of strategy and will probably have more lasting appeal than many.

Bringing Music Home



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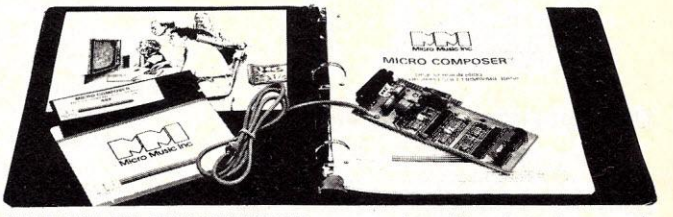

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Single Board Computers: Shopping Considerations

Rick Grossman

In recent years there have been a number of single board computers and evaluation kits made available to the microcomputing community. The purpose of this article is to help the educator, hobbyist and engineer decide which of these boards best suits a particular application.

The Hobbyist's Requirements

Many hobbyists have started with single board computers because they serve as excellent "teaching machines" for learning about the learning about the operation of the hardware and how to program. Documentation, ease of use and the availability of high-level languages are three important considerations for the person with this objective in mind.

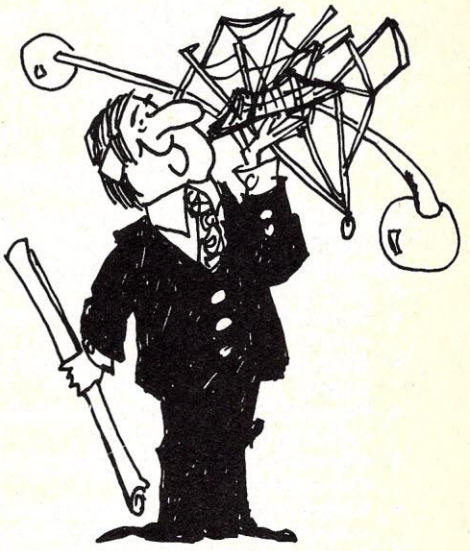
Rick Grossman, Instructor, Federal Correctional Institution, Lompoc, CA 93436.

The hobbyist who realizes that an Apple, North Star Horizon, or TRS-80 isn't intended as a 24-hour multitasking system will be looking to single board computers for such exotic tasks as turning the spinklers on and off and controlling lights and appliances around the home. Needless to say, getting into this type of dedicated controller application requires a little more than a fundamental background in hardware and interfacing.

Expansion to a larger system is an objective with some hobbyists and is accomplished easily with some boards and requires considerable effort with others. The ease with which a video display, external keyboard and printer can be added are especially important for the individual with little or no hardware background (although going through the frustrations and hopefully, successful interfacing of those devices can be quite an education).

Starting with a single board computer is an economical approach for expanding to a larger system. The expansion can be done in a step-by-step manner. Several boards are S-100 based or use the S-100 bus for expansion. As a result, the many S-100 boards on the market are available for expanding the system. Practically all units have expansion memory and I/O boards available from the manufacturer and, with the more popular boards, from second sources as well.

Assemblers and high-level languages, such as BASIC and FORTH, are available for several boards for those interested in learning programming. A cassette interface is important for saving user-generated programs, but the recording format is equally important if buying commercially available software is in the scheme of things. Although there isn't a whole lot available for single board computers, some can be obtained through user groups.



Engineer/Technician Requirements

The engineer or technician will be primarily interested in the evaluation or actual use of a single board computer. The unit will often be used as a dedicated controller to replace or improve an existing hardware system or as the core of an entirely new design application.

Shopping, con't...

Software considerations aren't usually as important as hardware capability because the software development, especially in the case of mass-produced units, is done on development systems. These are disk-based mini or micro systems running cross-assemblers for the board being developed. Upon completion the software is burned into PROMs, installed on the board, and then becomes the "operating system" for controlling the particular process for which the board was designed. However, for "one & two production runs, or for evaluation, the engineer/technician will often want a board with an assembler, keypad and LED display.

Some of the features an engineer looks for in a single board computer are: the number and type of I/O ports available, the amount of PROM space, interrupt capability and buffered I/O lines to allow easy interfacing to prototype circuits.

Educator Requirements

Single board computers are used primarily in schools for teaching students hardware and programming fundamentals and dedicated controller applications. They are not generally used for teaching computer

programming which is more suitable to personal computing systems, such as the TRS-80, Apple and others. The instructor will be using the computer as an instructional aid to supplement and complement classroom lectures. The board must be able to provide the student with "hands on" experience in learning how to control external devices. Good documentation is particularly important so the instructor doesn't have to develop a lot of material on fundamentals and operation and can concentrate on the course material dealing with applications.

Some important considerations for a single board computer to be used in a teaching environment are: easy maintenance, with all components and test points accessible; keyboard and display; TTY interface and assembler for program development; buffered I/O; good documentation, preferrably with an educational slant.

Making The Decision

The selection chart contains most of the important considerations when shopping for a single board computer. However, the chart should only be the first step in the decision process. The second step should be to contact the manufacturer for more detailed information and, hopefully, a copy of the documentation.

A few capabilities not listed in the chart which might be needed for certain applications include: DMA, interrupts, on-board timers, baud rates, type of cassette interface, documentation rating and on-board breadboarding area.

The type of microprocessor, I/O, price, programming and expansion capability are of interest to anyone buying a single board computer and the chart should help in meeting that end. □

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KIM-1	Commodore/MOS 901 California Ave. Palo Alto, CA 94304	8	6502	1K	2K	24 Key Hex	6 Digit LED
SUPERBOARD II	Ohio Scientific 1333 S. Chillicothe Rd. Aurora, OH 44202	8	6502	4K	8K	53 Key Typewriter	Video
SYM-1	Synertek Systems 150-160 S. Wolfe Rd. Sunnyvale, CA 94086	8	6502	1K	4K	28 Key	6 Digit LED
AIM 65	Rockwell International P.O. Box 3669 Anaheim, CA 92803	8	6502	1K (a) 4K (b)	8K	54 Key Typewriter	20 character Alpha/ numeric LED
1802 Evaluation Kit	Local RCA Solid State Sales office	8	1802	256 bytes	512 bytes	Remote Calculator Keypad & display	6 Digit Hex LED
Cosmac VIP	RCA - Cosmac VIP New Holland Ave. Lancaster, PA 17604	8	1802	2K	4K	16 Key	Video on Board
ELF II	Netronics R&D Ltd. 333 Litchfield Rd. New Milford, CT 06776	8	1802	256 bytes		24 Key	2 Digit LED
Super Elf	Quest Electronics P.O. Box 44305 Santa Clara, CA 95054	8	1802	256 bytes	32K bytes	24 Key Hex	6 Digit LED & Video
Micro 68	Electronic Products 1157 Vega San Diego, CA 92110	8	6800	128	512	16 Key	6 Digit LED
Educator II	Motorola HEP/MRO 705 West 22nd St. Tempe, AZ 85282	8	6800	128	512	8 Toggle switches	LED Lamps
Wince	Wintek Corp. 902 N. 9th St. Lafayette, IN 47904	8	6800	128	512 (EPROM)	None	None
ET 3400	Heath Company Benton Harbor Michigan 49022	8	6800	256	1K	17 Key	6 Digit LED
MD-6906	MicroDaSys P.O. Box 3605, Los Angeles, CA 90036	16	6809	1K	Mon Bug II	None	None
PAIA 8700	PAIA Electronics P.O. Box 14359 OklahomaCity,OK 73114	8	6503	512	256	24 Key	2 Digit LED
SDK 86	Intel Corp. 3065 Bowers Santa Clara, CA 95051	16	8086	2K	8K	24 Key	8 Digit LED
Intercept Jr. Tutorial	Intersil Inc. 10900 N. Tantau Cupertino, CA 95014	12	6100	256	1K	12 Key	8 Digit LED
TM 990/189	Texas Instruments P.O. Box 1443m/s 6404 Houston, TX 7700	16	9900	1K	4K	45 Key	10 Digit LED
Adaptable Board Computer	Signetics 811 E. Argues Ave. Sunnyvale, CA 94086	8	2650	512	1K		
Nibbler	DigiKey P.O. Box 667 Thief River Falls, MN 56701	8	SCMP/II	2K	4K		
Z80 Starter Kit	SD Systems P.O. Box 28810 Dallas, TX 75228	8	Z80	1K	2K	28 Key	6 Digit LED
MIKE 8 Model 882	Martin Research 3336 Commercial Ave. Northbrook, IL 60062	8	Z80	4K	1K	20 Key	6 Digit LED
Basic Controller	Dyna Byte 4020 Fabian Palo Alto, CA 94303	8	Z80	4K	4K (EPROM)	Keyboard input port on Board	One 8 bit light port
Model SSC	Cromemco Inc. 280 Bernardo Ave. MountainView,CA94040	8	Z80	1K	8K	None	None
Explorer 85	Netronics R&D, Ltd. 333 Litchfield Rd. New Milford, CT 06776	8	8085	256	2K	None	None
TK 80A	Nec Micro Computers 173 Worcester St. Wellesley, MA 02181	8	8080A	1K	1K (PROM)	25 Key	8 Digit
SDK 85	Intel Corp. 3065 Bowers Ave. Santa Clara, CA 95051	8	8085	256	2K	24 Key	6 Digit LED

I/O	CASSETTE	HIGHER LEVEL LANGUAGE	POWER REQUIRED	PRICE	EXPANSION CAPABILITY	NOTES
2 Parallel Ports 1 20 mA	Yes	Tiny BASIC Microsoft BASIC FORTH available	+5 V +12V	$170	S100 Buss	
RS232	Yes	BASIC ROM on Board	5V ~~15V~~	$279	8K on Board	
4 Parallel Ports RS232 20 mA	Yes	BASIC ROM available	+5 V	$239	4K RAM; I/O 4K RAM on Board; 2 Parallel; 6K EPROM	
2 Parallel TTY	Yes	BASIC Assembler ROM available	+5 V +24 V	$375 (a) $450 (b)	4K RAM, 12K ROM on Board	20 character/line Printer on Board Enclosure available
2 Parallel RS232 or 20 mA Current Loop	No	Tiny BASIC listing in manual (2K)	Includes Power Supply	$325	4K RAM, to 1.5K ROM	Fixed point binary arithmetic ROM available
1 Parallel Port	Yes	Interpreter	+5 V	$249	32K RAM several modules available	
		Tiny BASIC	+5 V	$99.95 Kit		
		Tiny BASIC	+5 V	$106.95 Kit	Cassette, 4K Mem. & TTY/RS232 Expansion Board $89.95	Music Speaker included
2 Parallel Serial (1)	(1)		+5 V -10 V			Serial port (1) Cassette interface (1)
2 Parallel	Yes		+5 V	$169.95	256 Byte RAM on Board	
2 Parallel TTL	No	Tiny BASIC Available	+5 V +12 V -12 V	$298		64K Socketed
None	No		+5 +12 -12	$189.95 (Kit) $240.00	512 Byte RAM on Board	Power Supply on Board
					4K RAM, 20 mA, 1 cassette interface Monitor & Tiny BASIC	
20 I/O Lines RS232	Yes		+8 V +16 V	$239 (Kit) $299	10K PROM on Board	Real time Clock S100 Compatible
1 Parallel output 2 Parallel input	Yes (6)			$149.95 (Kit)	1K RAM, 1K ROM on Board 4K RAM	
3 Parallel 1 RS232	No		+5 +12	$780 (Kit) $550 Educ Institution	4K RAM on Board	
	No	Microinterpreter PROM on Board	+5 V or +10 V	$281	3K RAM, 1K ROM Parallel I/O Board & Serial I/O Board	
1 Parallel	Yes		+5 V +12 V -12 V	$299	2K RAM, 2K EPROM on Board EIA and TTY interface	
2 Parallel 1 RS232 or 20 mA	No		+5 V +12 V	$275 $190 (Kit)	24K	Socket PROM & CPU
110 Baud	No	BASIC (2)	+5V	$149.95	28 K (44 pin)	Socketed
2 Parallel Port	Yes		+5V +25 V (PROM Programming)	$249 (Kit) $399	S100 Buss 2K RAM on Board	Prom Programmer on Board
None			+5V	$895	1 Serial port 1 Parallel port	Parallel port available Prom Programmer on Board
1 Parallel input 1 Parallel output 1 RS232 or 20 mA	Yes	PROM on Board Industrial BASIC	+8 V +16 V -16 V	$750	16K RAM on Board	8 Relays on board Video Interface on Board
3 Parallel 1-RS232 on 20 mA		BASIC PROM available		$395 (Kit) $450	S100 Buss	
2 Parallel Ports 7 6 bit port	Yes	Extended BASIC	-8 +8	$129.95	S100 Buss 4K RAM, 8K ROM on Board	Keyboard/Video available
3 Parallel Ports	Yes	No	+5 +12	$299	4K RAM, 8K PROM on Board	
4 Parallel Ports 1 20 mA port	No		+5V -100 (TTY)	$300 Kit $210 Educ institutions	512 Byte RAM, 4K ROM on Board	System Design Kit

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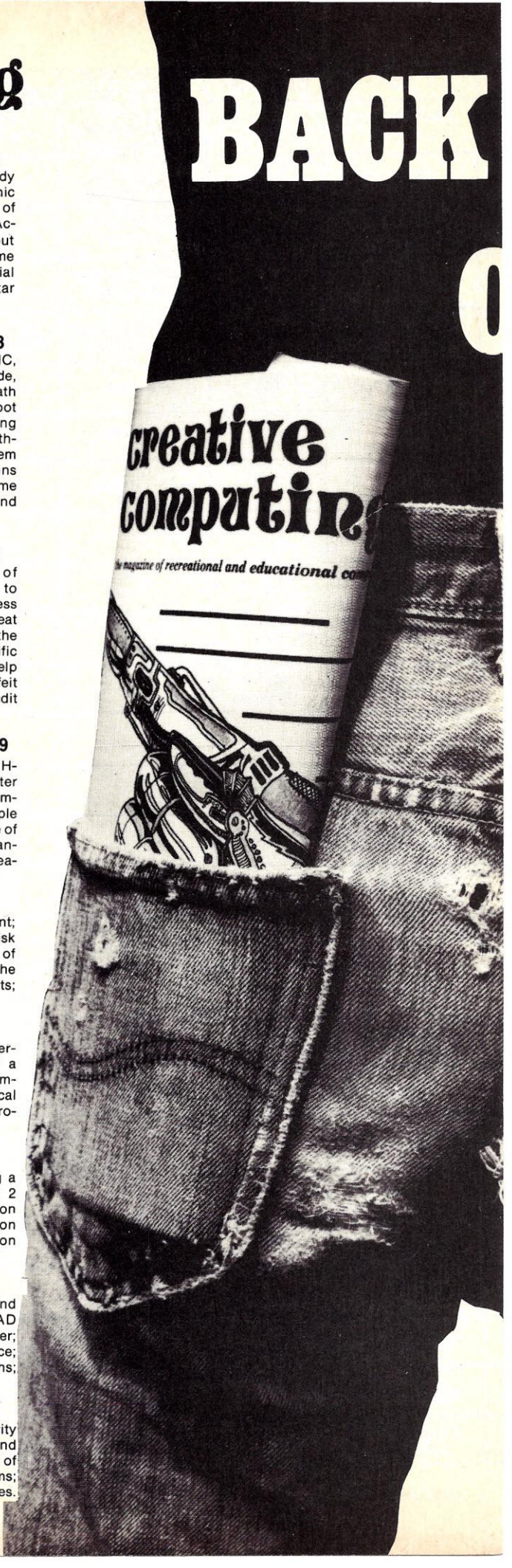

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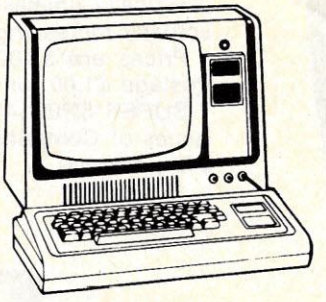
Personal Computer Comparison Chart

Steve North



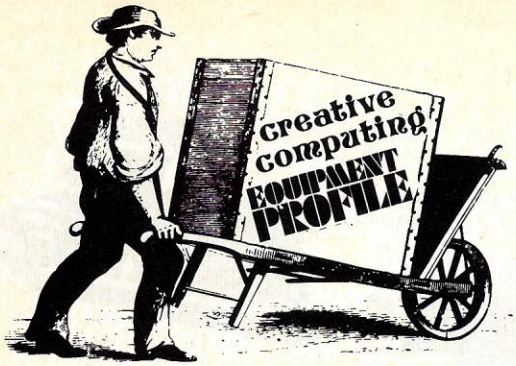
Although the accompanying comparison is self-explanatory, a few additional remarks are appropriate. To begin, the descriptions of the Atari and TI computers are somewhat sketchy since we only had manufacturer's literature from which to work. At the time of this writing (late August) neither company had actually delivered production models.

The comparison is also a bit subjective in a few categories, such as hardware quality and portability, but these ratings were arrived at after serious consideration. The availability of software from second sources is also not included but this is generally an important consideration unless you plan to write every program you want to use.

Finally, be aware that each computer is best for certain applications and it's impossible to select a computer that's the "absolute best" for everyone. The TRS-80 is one of the least expensive computers, has an excellent BASIC, and might be thought of as "every man's BASIC-speaking computer;" however, it seems less attractive when expanded beyond the basic 16K cassette-based system. The Apple is more expensive to begin with but is more sophisticated and is more competitive when more memory and disks are added. The PET made quite a splash when it was introduced and is still a good value but has a number of drawbacks. The Compucolor is an excellent color graphics machine and has found its own niche. The newer Atari and TI computers, with ROM cartridges and mass marketing, seem to be the wave of the future.

Computer	Radio Shack TRS-80 Level II	Apple II
Case	grey and black plastic	beige plastic
Keyboard	typewriter, 2-key rollover, upper-lower case, number pad	typewriter, n-key rollover upper case only
Memory	12K ROM (BASIC) 16K RAM (32-48K with expansion interface)	12K ROM (BASIC, monitor) 16-48K RAM
Language	Level II BASIC: 14 commands, 33 statements, 36 functions, 23 error messages	Integer BASIC: 20 commands, 30 statements, 8 functions, 15 error messages Applesoft BASIC: 12 commands, 48 statements, 27 functions, 19 error messages
Resident Machine Language Monitor	no	yes
Graphics	48x128 pixels B & W	40 x 40, 16 colors 280 x 160, 6 colors
Text	16 lines x 64 characters wide upper case only	24 x 40, upper case only video reverse and blink
Expansion	expansion interface, 1-4 disk drives, modem, voice synthesizer, printers	8 general-purpose I/O slots for disks, printers, speech boards, clocks, etc.
Realtime or Hardware Clock	In expansion interface	optional plug-in board
I/O Ports built-in	none	game paddles
Built-in Audio	no	1 voice
Audio Cassette	500 baud, motor control	1200 baud
Disk Capacity	drive 1 - 56K drive 2, 3, 4 - 82K	108K, 4 drives
Video Display	B & W TV monitor included	requires color TV
Factory Support and Repair	excellent	good
Portability	fair	good
Hardware Quality	fair	excellent
Price (16K RAM)	$849	$1195

Commodore PET	Compucolor II	Atari 800	TI 99/4
beige metal case	simulated wood grain and beige plastic	beige plastic	grey and black plastic
typewriter, n-key rollover, upper-lower case	typewriter, upper case and graphics	typewriter , upper-lower case	typewriter layout with space between keys
14K ROM (BASIC and OS) 8-32K RAM	16K ROM (BASIC, DOS, CRT mode) 8-32K RAM	8K ROM internal 8-32K cartridge 8-48K RAM	26K ROM internal 30K ROM cartridge 16K RAM
Commodore BASIC: 7 commands, 26 statements, 17 functions, 23 error messages	Disk BASIC 8001: 3 commands, 29 statements, 27 functions	Atari BASIC	TI BASIC: ANSI BASIC with sound and graphics 14 commands, 33 statements, 19 functions
no	no	no	no
64 graphics characters B & W	128 x 128, 8 colors 64 graphics characters	380 x 192, 16 colors	192 x 256, 16 colors
25 x 40, upper/lower or upper/graphics video reverse	32 x 64, in color	24 x 40, upper-lower case	24 x 32
IEEE-488 Bus, printer	2nd disk drive expanded keyboards	printer, disks, modem	speech synthesizer, modem, printer, cassette recorder, disk drives
yes	yes	interval timer	interval timer
parallel port	RS-232	game paddles, light pen	general-purpose I/O port, RS-232 option
no	no	4 voices	3 voices, noise generator
500 baud (?)	no (floppy disk built-in)	600 baud	optional, 1300 baud
?	51K, 2 drives	80K, 4 drives	80K, 4 drives
built-in B&W monitor	color TV monitor included	requires color TV	color TV monitor included
fair	good	?	?
good	fair	good	fair
fair to good	good	?	?
$795	$1695	$1000	$1150



Radio Shack's Low-Cost Quick Printer II

George Blank

One year ago I was convinced that if I wanted to work hard enough, I could pick up an old beat-up Teletype and interface it to my computer so I could have hard copy for only $400 or $500. I wouldn't expect much, but it would at least help my programming by providing line listings. If I was offered a brand new printer, complete with interface, for $220, I would have danced for joy. At it was, until I was asked to edit SoftSide magazine this spring, I couldn't afford any kind of printer.

However, Radio Shack is now offering a printer so cheap, I could afford to buy it as a backup. And what a printer! The Quick Printer II includes a built in microprocessor to operate it, comes with three built in interfaces, prints in upper and lower case and sells for $219.

Features

The Quick Printer II is small; 6½ inches wide, 9½ inches deep, and 3¼ inches high. It prints on special electrolytic paper just under 2½ inches wide, about the same size as a cash register tape. There are three built in interfaces, for direct connection to the TRS-80 bus, for a Centronics parallel printer port and for RS-232 serial connection. It comes with a 22 inch ribbon cable to connect it to the bus on the back of a TRS-80. The cable to connect it to the line printer port is an additional $19.95. As it comes, it will not work with the expansion interface, for the TRS-Bus on the expansion interface does not carry the LPRINT and LLIST functions. You would either have to buy the line printer cable, or use the RS-232 board and the port on the front of the expansion interface, building your own connecting cable according to instructions in the Quick Printer II manual. It should not be hard to connect to any RS-232 port on any computer, as serial operation is simple and requires only 3 wires connected to a 5 connector DIN jack.

George Blank, Pastor, Calvary United Presbyterian Church, 266 Second St., Leechburg, PA 15656.

For serial operation, it is only required that the computer monitor the handshake strobe, and when the printer signals a ready, send one bit of data. The three lines are CLEAR TO SEND, DATA and GROUND. The printer will accept 7 bit ASCII data, even or odd parity, with one or two stop bits, 7 bit ASCII data, no parity, with two stop bits, or 8 bit ASCII data, no parity, one or two stop bits. No testing is done by the printer for parity errors.

The author's 32K TRS-80 system with a single disk, 16K Level II, Microcomputer devices printer and Quick Printer II.

The character set is a modified ASCII subset, printing codes 33 (exclamation point) through 127 (DELETE, printed as a solid block), substituting arrows for codes 91 to 94, as found in the Radio Shack User's Manuals. The lower case characters g, j, p, q and y do not descend below the line, but are printed in raised position. The printer ignores bit 7, and prints the graphics characters as a duplicate set of the other characters. Of the 32 ASCII control codes, the printer ignores all but two; the carriage return (code 13) and SHIFT IN (code 15). If shift in is the first character on a line, it switches the printer from the 32 character per line mode to 16 characters per line for that one line only. The printer is a line printer, storing the characters in a buffer, and not printing until it receives 32 characters or a carriage return. The character spacing is 6 lines per inch vertical and either 18 or 9 characters per inch horizontal, software selectable. The format is a 5 x 7 dot matrix.

The Quick Printer II is very quiet, making no sound at all when it is not printing, and only the sound of the paper feed when printing. For that reason alone I prefer it to my Selectra Print when making a long listing and, in addition, it is four times as fast, printing at 64 characters per second.

Since the printer is almost all electronic, the paper feed and the print head being the only moving parts, maintenance should be minimal. Recommended maintenance is simply to avoid physical shocks to the printer, keep it dry, and if print quality deteriorates, clean the print head with a fine brush. The print head has a stated life of 30 million characters. (Let's see—at 64 characters per second, that means I could wear it out in 5 days, 10 hours, 12 minutes and 6/10 of a second, if I found a roll of paper long enough!)

In keeping with Radio Shack's typical profit margins of 65%, the unit is all plastic except for the electrical parts. The paper sits in a well on top of the printer on a plastic rod, and a pencil stub would probably do just as well for a roller if you ever break or lose the original. A red LED tells when the unit is on, and the electronic parts are visible through ventilation holes in the top and bottom of the unit. The power requirement is 120 VAC, 60 Hz, and a three wire grounded plug is necessary. The extra ground is not only for safety, but to insure reliable operation.

The unit comes with two rolls of paper, the connecting cable to the back of the TRS-80 keyboard unit and a twenty-two page instruction manual. The manual covers hook up, operation, paper loading, problems, specifications and provides a schematic. Programs in the manual include the use of the two control codes, printing continuously in the 16 character per line mode, assembly language driver routine and demonstration of lower case. Optional features include extra paper at $3.95 for a package of 2 rolls, and the expansion interface connecting cable for $19.95. The Quick Printer II sells for $219.

I've finally found a personal computer I respect. Compucolor II.

It's not surprising that professionals get excited about the Compucolor II. It's a totally-integrated 8080A system with full color graphics display, built-in 51K mini-disk drive, and the best cost performance ratio available in a personal computer.

The complete system is only $1595.*And that price includes 8K user RAM, RS-232C compatibility and random access file capabilities.

Our 8 foreground and background colors will boost your comprehension, while introducing you to an exciting new dimension in BASIC programming. The vector graphics have 16,484 individually-accessible plot blocks. And the 13" diagonal measure screen gives you 32 lines of 64 ASCII characters. You also have the flexibility that comes with 16K Extended Disk BASIC ROM.

Compucolor II offers a number of other options and accessories, like a second disk drive and expanded keyboard, as well as expandability to 32K of user RAM. Of course we also have a whole library of low-cost Sof-Disk™ programs, including an assembler and text editor.

Visit your nearest computer store for details. And while you're there, do some comparison testing. With all due respect to the others, once you see it, you'll be sold on the Compucolor II.

Compucolor® Corporation

Unretouched photo of screen

*U.S. Domestic price

Compucolor Corporation • Intecolor Drive • Technology Park/Atlanta • Norcross, Georgia 30092 • Telephone 404/449-5996

CIRCLE 121 ON READER SERVICE CARD

Quick Printer, con't...

Operation

The unit is simple to operate. Controls include an on/off switch, a switch to select TRS-80 bus, line printer, or serial input and an on line/off line/ reset switch that can be used to interrupt a printout. At power on, the unit prints a READY message with a code indicating the input mode selected. The unit should be powered on prior to the computer and not turned off during computer operation to avoid a system lockup.

The paper is easy to load and unload, and the only other requirement for operation is software, which can be as simple as the commands LLIST and LPRINT.

Application

Quite frankly, there is a drastic difference in capability between the Quick Printer II and my dual pitch, 15 inch carriage, Micro Computer Devices Selectric. But not all the advantages are in favor of the Selectric. To get the Selectric working required $30 in long distance telephone calls, two service calls from IBM and shipping the interface on a round trip coast to coast at a cost of $20. I am terrified when I consider what the cost would be if it were out of warranty. With the Quick Printer II, I simply took it out of the box, read the instructions, plugged it in and it worked.

The Printer, instruction manual and paper.

Obviously I prefer to use the Selectric for articles and suspect that any editor receiving a long article printed on the Quick Printer II would immediately throw it in the trashcan! But for my own use, I prefer the quick printer for line listings. It is cheaper, much faster and much quieter. Once, when I was disassembling Level II BASIC for analysis, I had the Selectric running continuously for three and half hours. I was only one third of the way through when impending divorce terminated the project! My family could no longer tolerate the clatter.

But there is a particular use for which the Quick Printer II seems ideally suited. It makes a wonderful portable terminal for the TRS-80, so you don't have to carry the awkward, heavy, television set with you to use your computer away from home. Following a few simple steps, this is easy. First, keep in mind that the Quick Printer II will not support graphics characters. Then remember that it stores characters in a buffer until a carriage return is received. This calls for a little care in programming. For example, an input statement like this would not work:

```
100 INPUT"YOUR ANSWER";A$
```

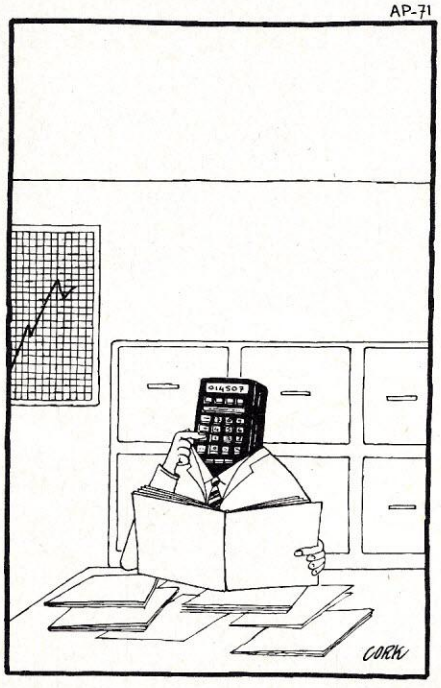
The statement and the prompt would be invisibly stored in the buffer, and you would not know why the printer was just sitting there. However, this simple modification would work:

```
100 PRINT"YOUR ANSWER?":
    INPUT A$
```

The carriage return at the end of the print statement would cause the line to be printed, serving as a prompt. Note that this requires a question mark in the print statement to indicate an input request as the question mark in the INPUT line will not be printed until the statement is received.

This simple program, executed prior to other programs, places the printer driver routine in place of the video driver in the computer, and will cause all print statements going to the screen to go to the printer instead:

AP-71



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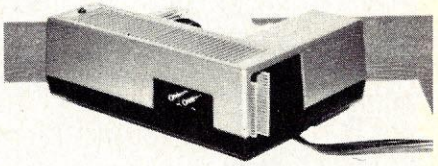
```
1 FOR I = 16413 TO 16420:
  POKE I, PEEK(I + 8): NEXT I
```

This is not a total solution, as any values poked into screen memory and graphics characters will not be shown. But in programs designed or modified for mobile use, it can be very helpful.

It is quite easy to transport the keyboard, power supply, cassette recorder, printer and a three plug extension cord in a small suitcase. You could even take your computer to parties and introduce your friends to games set up for the printer, like



Quick Printer II from back, showing connectors and selection switches.

Hammurabi, Hunt the Wumpus, or Oregon Trail. For business use, there is the added attraction of a hard copy record of work accomplished. You could even do word processing on the Quick Printer II, saving the edited output on tape for later printout on another printer.

Recommendation

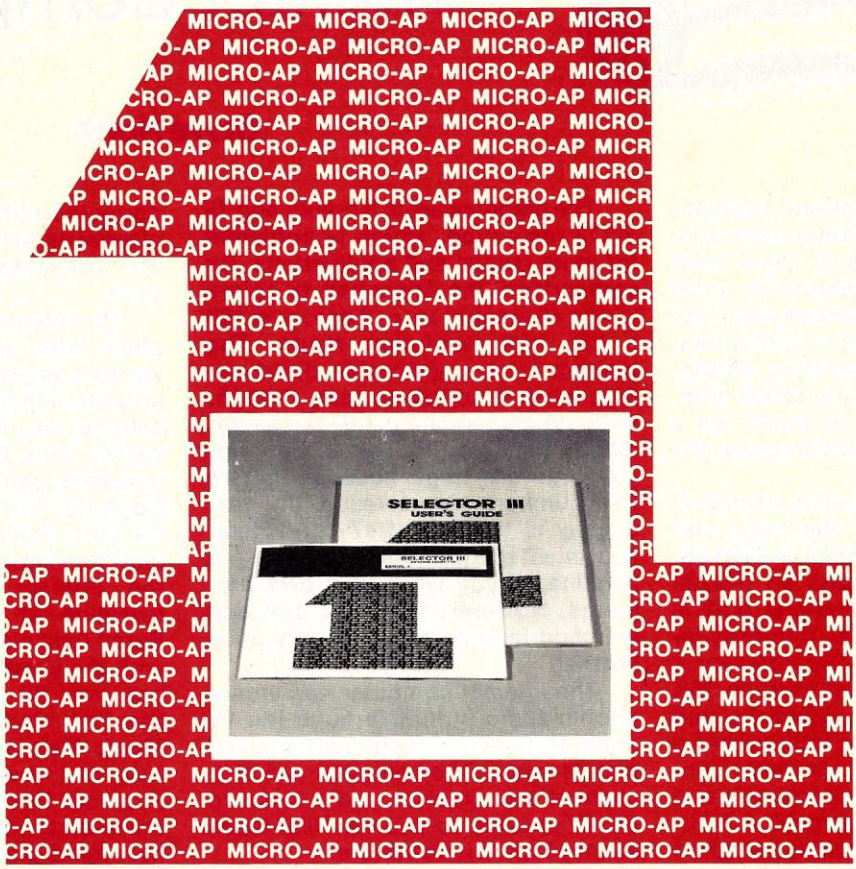
The sign in the small town reads; "There is no place like this place anywhere near this place, so this must be THE PLACE." That is the situation with the Quick Printer II. There is no other product that comes close to it in features and capability. With its choice of interfaces, it should be popular, not only with the Radio Shack computer, but with many others as well, particularly those with a built-in RS-232 serial port. The price is quite reasonable and the unit is very portable. I am quite happy with mine, and have only two complaints: Sometimes it prints the first line of a listing or print-out in 16 character per line format when I did not specify it, and if you pick up the printer and tilt it, the paper falls out and unrolls all over the floor. That is not a very nice feature in a printer that I use primarily as a portable, but I will either have to rig up a catch over the paper rod or learn to carry it upright.

There may be one further problem for prospective purchasers. Radio Shack has been having trouble obtaining the microprocessor chips in quantity, and the Quick Printer II may be backordered. I frankly expect a huge demand for it, not only for the price, but also for the features. □

SELECTOR III - C2
THE INFORMATION MANAGEMENT SYSTEM

Includes these Application Sub-Programs. . .

Sales Activity, Inventory, Payables, Receivables, Check/Expense Register, Library Functions, Mailing Labels, Appointments, Client/Patient Records



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SELECTOR III-C2 ALLOWS INSTANT RECALL OF ANY RECORD USING ANY INFORMATION ITEM IN THE RECORD. That statement deserves re-reading, because that ability makes **SELECTOR III-C2** the most powerful information management system in microcomputers today!

The three major activities in business computing are...Word Processing, Financial Accounting, and the storing, processing, and reporting of information. The latter is where **SELECTOR III-C2** shines and fills the professional and personal need.

The system represents the state of the art using Micro-Ap's unique record indexing, query, and report writing methods. It's 'menu driven' and uses screen displays with all the instructions and error sensing that allow the novice to quickly learn the system and accomplish his tasks.

With **SELECTOR III-C2** you...

- define a record format assigning up to 24 fields as 'key' fields -meaning that records can be instantly recalled by name, date, quantity, ZIP Code, or whatever.
- create a file and begin entering edited and verified data immediately.
- browse through your file in key field order, making whatever changes or deletions needed.
- select collections of records meeting your exact requirements and arranged in the order wanted.
- create a unique report that contains the precise information you need - with numerical totals, averages, maxima, and minima -for any period of time and summarized by name, date...or by any item you want.
- bring an application on-line in hours instead of months.

SELECTOR III-C2 is a 'turn-key' system that can manage most applications as is. It includes source-code and pre-defined record formats and sub-programs to perform the tasks listed at top of page. Programmers can easily add other sub-programs - using the system's powerful utilities - to perform virtually any special computation or function required.

The system runs under CBASIC Vers. 2, and is priced at $345. It's available in a variety of CP/M, disk formats including Dynabyte; North Star; Micropolis; TRS-80; Helios II; Heathkit; iCOM; Altair; Imsai; Cromemco; and others.

Available from computer stores worldwide:

LIFEBOAT Associates
2248 Broadway, Suite 34,
New York, N.Y. 10024 • (212) 580-0082

Or order direct from

MICRO-AP
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(415) 828-6697

CIRCLE 165 ON READER SERVICE CARD

A Low Cost Personal Computer

Interact Computer

Steve North

Although the power and sophistication of personal computers continues to leap forward, there have been few serious attempts to lower price barriers. Even the new Atari and Texas Instruments microcomputers, both solid but unsurprising efforts, are priced at or above the $1000 level. Thus, we're pleased to report on a new, low-cost personal computer, the Interact Computer.

The Interact Computer comes in three configurations: the basic unit with a tape loader in ROM is $499.95. The same computer with an RS-232 printer and communications port is $599.95, and the Level II BASIC-in-ROM unit with the RS-232 interface is $699.96. All the models include 16K RAM, color graphics, joysticks and plug into a TV set. The Interact has a built-in RF modulator for direct connection to the antenna terminals and apparently has FCC approval. A built-in cassette deck provides program and data storage.

The term "Level II" BASIC is an obvious allusion to TRS-80 Level II since Interact does not even have a "Level I" BASIC. It is also a somewhat inaccurate term because Interact Level II is not the same as TRS-80 Level II and some program conversions might be difficult. Both BASICs were written by Microsoft and customized for each particular machine, but Interact BASIC appears to be enhanced 8K BASIC whereas TRS-80 Level II is enhanced Extended 12K BASIC. The Interact does not have IF-THEN-ELSE (only IF-THEN), PRINT USING, EDIT, AUTO, or integer and double precision variables. However, it retains many of the most powerful features of TRS-80 Level II, such as multidimensional arrays, character string arrays, PEEK, POKE, single character input, etc. In addition, Interact BASIC has several statements for high-level control of the display color, text scrolling window and audio output.

The graphics are in 8 colors and 78 x 113 resolution, which is sufficient for most games and applications. By comparison, the Apple has 16 colors in 40 x 40 resolution, or 6 colors in 160 x 280 high-resolution mode. The Interact is at a noticeable disadvantage when it comes to text, though, since characters are displayed as dot matrix patterns on the same grid, yielding very large squarish letters and numbers. As a result the text display is 12 lines of 17 characters, equivalent to 3 or 4 lines of BASIC — a handicap if you write your own programs. However, the color graphics are good for a computer in this price bracket.

The Interact computer has monophonic audio output through the TV speaker, useful for sound effects and simple tunes. The computer can also channel the cassette audio input to the TV speaker so you can hear tapes as they load, a nice feature.

The joysticks are not true analog inputs, but work by activating contact switches to detect the direction in which the stick is pushed. Each joystick has a "fire" button and a control knob mounted at the end of the stick for analog input, such as game paddle positioning. The keyboard layout is like a typewriter but there are spaces between the keys. The keys work like calculator buttons, to be stabbed at rather than gently pressed, which is fine for hunt-and-peck typists but not for touch-typists. We also had a little trouble with bad contacts in the joystick units. This could probably be corrected with some TV Tuner aeresol cleaner or, at the very worst, by taking the joysticks apart and cleaning them.

The Interact Computer is not supplied with software from second sources yet, but Interact has released an adequate line of games and applications on its own. Our favorite games were Breakthrough (a Breakout-style game), Backgammon and Dogfight. This last game commanded the time of our software development staff for almost a half hour a day while the Interact was in our office, revealing at least one latent Red Baron (and also some dissatisfaction with the joystick units). Interact also has over 20 other tapes, including Star Trek, Computer Maze, Hangman, Music Maestro, Compute-a-Color (a color etch-a-sketch program) and two Financial Planning cassettes. Most of the Interact software is very good (but not mind-blowing) and the prices (around $14.95 a program) are likewise OK but not exceptional.

In summary, the good points of the Interact are:

*Inexpensive
*Good BASIC
*Color Graphics

And the bad:

*Not expandable
*Limited text displays
*Keyboard and joystick quality

In interpreting this review, please keep in mind that it's not very significant to compare a $600 computer like the Interact, with a computer costing two or three times as much. For example, the Apple has a better keyboard, expandability and more software, but it costs $1195. If you pay less, you have to expect to give up something. For its price, the Interact is a good performer and it's worth your consideration if you're looking for an under-$1000 personal computer. □

DIGITAL RESEARCH

Software with Manual / Manual Alone

- **CP/M* Floppy Diskette Operating System** — Packages supplied on diskette complete with 8080 assembler, text editor, 8080 debugger and various utilities plus full documentation. CP/M available configured for most popular computer/disk systems including: North Star Single, Double or Quad density, Altar 8" disks, Helios II, Exidy Sorcerer, Vector MZ, PolyMorphic 8813††, Heath H17† or H89†, TRS-80†, iCOM 3712 and iCOM Micro Disk plus many other configurations available off the shelf ..... **$145/$25**
- **MAC** — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Z-80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below) ..... **$100/$15**
- **SID** — 8080 symbolic debugger. Full trace, pass count and break-point program testing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values ..... **$85/$15**
- **TEX** — Test formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer ..... **$85/$15**
- **DESPOOL** — Program to permit simultaneous printing of data from disk while user executes another program from the console ..... **$50/$10**

All Microsoft prices are discounted!

MICROSOFT

- **Disk Extended BASIC** — Version 5, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records ..... **$300/$25**
- **BASIC Compiler** — Language compatible with Version 5 Microsoft interpreter and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules ..... **$350/$25**
- **FORTRAN-80** — ANSI '66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) ..... **$400/$25**
- **COBOL-80** — ANSI '74 Relocatable object output. Format same as FORTRAN-80 and MACRO-80 modules. Complete ISAM, interactive ACCEPT/DISPLAY, COPY, EXTEND ..... **$625/$25**
- **MACRO-80** — 8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included ..... **$149/$15**
- **EDIT-80** — Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included **$89/$15**

MICRO FOCUS

- **CIS COBOL (standard)** — ANSI '74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal ..... **$850/$50**
- **CIS COBOL (compact)** — COBOL subset compiler for use on a 32K byte microcomputer. Valuable range of COBOL language features, many at level 2 and including ISAM and the CIS COBOL interactive screen formatting of dumb terminals ..... **$650/$50**
- **Forms 1** — CRT screen editor to build application CRT formats with protected and unprotected field areas. Output is COBOL data descriptions for copying into CIS COBOL programs. Eliminates the chore of writing screen input and output descriptions by hand and greatly speeds interactive application programming. Output requires CIS COBOL compact compiler ..... **$125/$20**
- **Forms 2** — Forms 1 screen editor plus indexed file application program generator. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by either of CIS COBOL compilers ..... **$200/$20**

EIDOS SYSTEMS

- **KISS** — Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. ..... **$535/$23**
- **KBASIC** — Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS.REL as described above, and a sample mail list program ..... **$995/$45**

*CP/M is a trade name of Digital Research.
**Z80 is a trademark of Zilog, Inc.
***UNIX is a trademark of Bell Laboratories.
****WHATSIT? is a trademark of Computer Headware.
†CP/M for Heath, TRS-80 Model I and PolyMorphic 8813 are modified and must use especially compiled versions of system and applications software.
††PolyMorphic 8813 CP/M scheduled for September 15 release.

All Micropro prices are discounted!

MICROPRO

Software with Manual / Manual Alone

- **Super-Sort I** — Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. etc. Even variable number of fields per record! ..... **$225/$25**
- **Super-Sort II** — Above available as absolute program only ..... **$175/$25**
- **Super-Sort III** — As II without SELECT/EXCLUDE ..... **$125/$25**
- **Word-Star** — Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning **$445/$25**
- **Word-Master** Text Editor — In one mode has superset of CP/M's ED commands including global searching and replacing, forward and backwards in file. In video mode, provides full screen editor for users with serial addressable-cursor terminal ..... **$125/$25**

SOFTWARE SYSTEMS

- **CBASIC-2** Disk Extended BASIC — Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables, etc. ..... **$109/$15**

Structured Systems prices are discounted!

STRUCTURED SYSTEMS GROUP

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- **SELECTOR III** — Multi (i.e., up to 24) Key version of Selector II. Comes with applications programs including Sales Activity, Inventory, Payables, Receivables, Check Register, Expenses, Appointments, and Client/Patient. Requires CBASIC. Supplied in source code .**$295/$20**
  Enhanced version for CBASIC-2 ..... **$345/$20**
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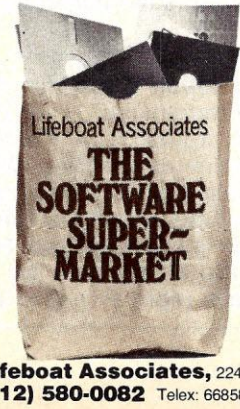
Software for most popular 8080/Z80 computer disk systems including ***NORTH STAR, iCOM, MICROPOLIS, DYNABYTE DB8/2, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR MZ, 8" IBM, HEATH H17 & H89, HELIOS, IMSAI VDP42 & 44, REX, POLYMORPHIC 8813, OHIO SCIENTIFIC*** *and* ***IMS 5000*** *formats.*

Shopping List No.6



Orders must specify disk systems and formats: e.g. North Star single or double density, IBM single or 2D/256, Altair, Helios II, Micropolis Mod I or II, 5¼" soft sector (Micro iCOM/SD Systems Dynabyte), etc.

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Three User-Definable Character Generators for the Apple

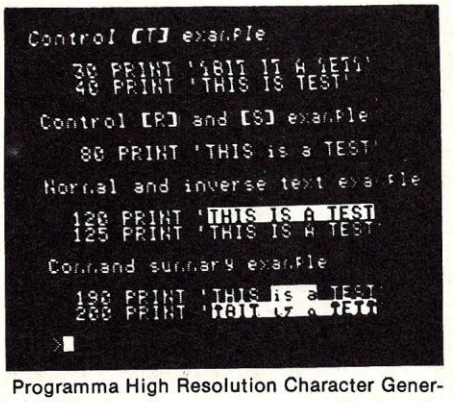
Steve North

A few years ago a personal computer called the ECO Micromind was heavily advertised but never actually came to the market. The main attraction of this not very tangible machine was its user-definable character set, allowing one to program special characters like little spaceships, chess pieces, the Greek alphabet and so on. Interestingly enough, this capability has always existed in the Apple II computer, and the software for user-definable character generation is available now. (This reveals exceptional foresight in designing a personal computer with such latent capabilities waiting only for the right software to be written.)

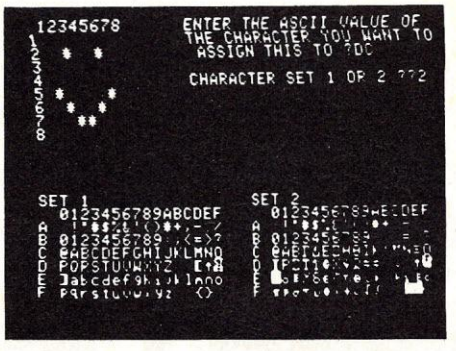
The basic technique makes use of Apple high-resolution graphics. The Apple can plot 53760 points on a 192 x 280 grid, which many people use for graphs, pictures, games, etc. This grid can also be broken down into blocks in a 24 x 40 format and then each point is used as part of the dot matrix in forming characters. This layout yields the same number of characters on the screen as in normal text mode, but the character fonts are software controlled. So you can display upper and lower case characters, or anything else you can draw within an 8 x 7 matrix. One minor drawback to this scheme is that it requires extra memory and software to generate the displays, scrolling, cursor movement and other screen functions.

For this review we tried three different packages for creating and displaying user-definable characters.

High-Resolution Character Generator (by Programma) is a disk-based set of programs. A machine-language routine called Hires-Writer actually creates the text displayed on the high-resolution graphics screen. When the disk is bootstrapped, Hires Writer and the binary data for two character sets (normal upper-lower case and Greek) are loaded from disk and the character generator software is activated. Characters from both character sets can be displayed on the screen at the same time, but obviously only one may be selected for printing. Control characters allow you to switch from one character set to another, set upper or lower case, video inverse, move the cursor, initialize the screen, etc. For example, typing or printing control-R means that all following characters will be in lower case. Control-S returns to upper case. This allows entry and display of lower case although the keyboard is upper case only.


Control [T] example
30 PRINT '8BIT IT A 'SET'
40 PRINT 'THIS IS TEST'
Control [R] and [S] example
80 PRINT 'THIS is a TEST'
Normal and inverse text example
120 PRINT 'THIS IS A TEST
125 PRINT 'THIS IS A TEST'
Command summary example
190 PRINT 'THIS is a TEST'
200 PRINT 'that is a TEST'

Programma High Resolution Character Generator.



Programma character definition mode.

The Hires Writer program works within a user-defined window which can be the entire screen or any portion of it. The boundary rows and columns are poked into low memory. Hires Writer is completely transparent to Integer BASIC, Applesoft in ROM and the Disk Operating System. It won't work with Applesoft in RAM.

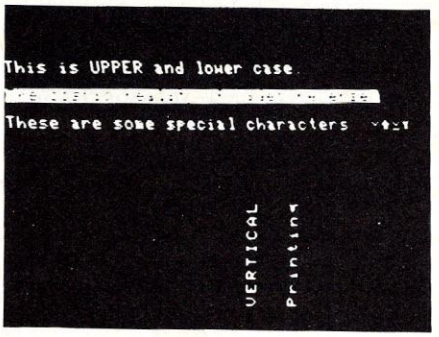
To define your own special characters, the disk includes a program called CHAR GEN which lets you set up the dot matrix for any character in either character set, using a larger display with asterisks for the points. When you're done you can write the new character set onto a disk file.

Overall, we rate this product highly. The documentation is sufficient and the software is easy to use even if you don't know anything about machine language. $19.95 from Programma International, Inc. 3400 Wilshire Blvd., Los Angeles, CA 90010. (213) 384-0579.

Superchip (by Eclectic Corporation) is a ROM that plugs into the empty socket at D000 on the Apple motherboard. Thus, it is not necessary to load any software from cassette or disk: merely type *D000G when the Apple is turned on, and thereafter the high-resolution character display is activated. The Superchip supports upper and lower case (with descenders), cursor control, tabs (with eight user-settable stops, a text window, reverse video, one special character or an entire set, screen clear, etc. Setting up alternate character sets is done by creating a binary table in memory. Eclectic supplies a program called Character Edit for creating the table on cassette (for $19.95 extra) but we did not get one with our review copy, so we can't comment on its operation.

Superchip has two unusual features: character rotation and editing. When control-T is printed on the

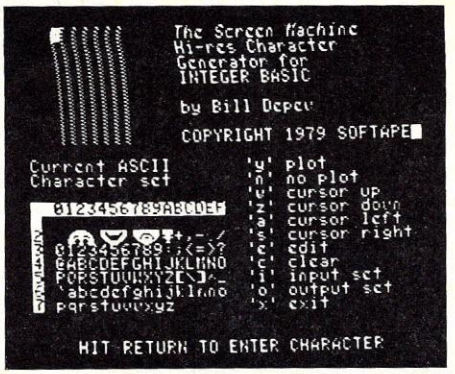
screen, the character behind the cursor is rotated —90 degrees. This allows you to easily print characters sideways and upside down. (A neat idea, but probably not something you'll use everyday.) The edit mode operates on any record on the screen (any set of characters separated by a carriage return) with character insertion and deletion. Superchip also has 30 new built-in characters, mostly math symbols. It works with both Integer BASIC and Applesoft in ROM, but not with the DOS, because the Superchip software was written before the Apple Disk was available. (Machine language routines to connect DOS with Superchip are available for $19.95.) However it is possible to load and save programs from disk by de-activating Superchip. One minor difference between Superchip and the two other packages is that Superchip stores lower case characters as lower case internally. The other packages apparently just convert the output to lower case as it is displayed.



Superchip display.

In summary, Superchip would be a good choice if you don't have a disk, don't want to load software from cassette or disk, or if having descenders character rotation, or other Superchip features is important to you. It also saves some of your memory by putting most of the routines in ROM, but it's expensive. $99.95 from Eclectic Corporation, 2830 Walnut Hill Lane, Dallas, TX 75229. (214) 358-1307.

The Screen Machine (by Softape) is sold on cassette but works with both cassette and disk systems. The Screen Machine character generator program is executed to initialize a character set and enable the display. The Screen Machine comes with a standard character set built-in, but you can modify it or enter completely new characters, with a blown-up display of the dot matrix. The entire character set and software drivers to display it (called a prefix) may be saved on tape or disk. The prefix can later be appended to your own BASIC programs or loaded by itself for software testing and development, thus eliminating the need to always load a separate program first.



Softape Screen Machine definition mode.

The Screen Machine also operates on a text window and has control characters to switch between upper and lower case, like the other high-resolution character generators. It also has some advanced features for graphics manipulations which appear to be ideal for animation. For example, besides sending the character output straight to the hi-res graphics page, the software can maintain both a "source page" and a "destination page," and can do operations involving both the source page and the character to be displayed to create the destination page. This feature is probably beyond the needs of most users but would be very handy for graphics rotation and animation.

In addition to this software, the Screen Machine comes with a Hires-Graphics Prefix which you can incorporate into your Integer BASIC programs to do normal point and vector plotting much like the Applesoft II Hi-res routines. The manual lists the entry points to the machine language subroutines and gives several examples. It does not seem possible to have multiple character sets since the character data is stored at one fixed location in memory.

Screen Machine in use.

Overall, the Screen Machine is a nicely conceived package. Although it does not have character rotation or multiple character sets, some of its other functions are at least as exotic as those of the other two programs. Available for $19.95 from Softape, 10432 Burbank Blvd., North Hollywood, CA 91601. (213) 985-5763.

The Dan Paymar Lower Case Adapter is worth mentioning in this review, although it does not provide user-defined characters, because it's one of the simplest ways to get lower-case characters. The LCA is a small plug-in board which adds a second video generator ROM for lower case. Lower case characters written to the screen are automatically displayed as lower case, thus obviating the need to reserve more than 8K of memory for the high-resolution screen map and output drivers. It also functions with low-resolution color graphics and text editors. Unfortunately the LCA is not totally hardware-based because the Apple I/O routines convert lower-case bit patterns to upper-case, and the keyboard is unable to encode lower case, so a short BASIC subroutine is required. If all you want is to add lower case characters, then this may be the best way to do it. Also note that the Dan Paymar Lower Case Adapter would not prevent use of a separate high-resolution character generator. $49.95 from Dan Paymar, P.O. Box A-133, C.S. 6800, Costa Mesa, CA 92627.

Conclusion

If you have an Apple computer, it's probably worth your while to buy one of these packages. In this particular case, all the products reviewed are excellent (but varying somewhat in price) and your choice will depend on the particular features in which you're interested. They all expand the power of the Apple graphics immensely with only moderate memory requirements. One feature I wish someone had included was smooth scrolling, i.e., scrolling a part of a line at a time instead of the entire line so that the display changes smoothly instead of jumping. Though this might have been too slow for practical usage. Remember before buying that although the hi-resolution character generators are transparent to BASIC programs, they still require extra memory for the screen and driving software. The Superchip works in a 16K system, and the other two programs require at least 24K. □

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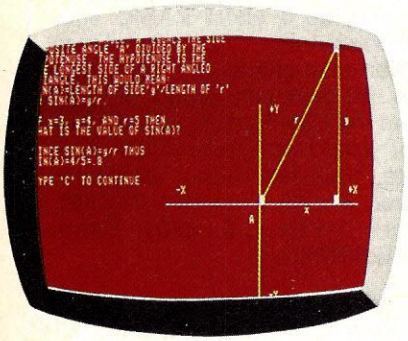

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ED2	Six "How To" lessons on beginning BASIC techniques.	$ 29
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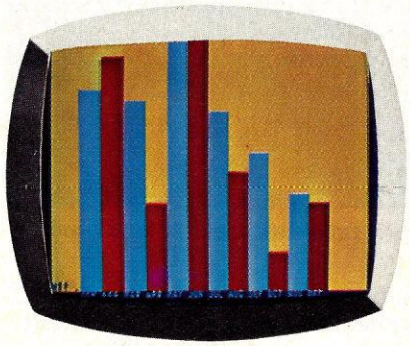
ED5	Covers the metric system (tutor, quiz and conversions) Roman numerals and time telling.	$ 29
ED6	Advanced sciences (2-disk set) including nuclear and organic chemistry, genetics, physics equations and function graphics.	$ 29
*ED7	Alphabet tutor and quiz, number tutor, memory match and recall game (color & B/W).	$ 29
ED8	Language disk, covering vocabulary and verbs for German, French and Spanish.	$ 29
ED9	Word search game and Hangman drawing, with large on-line data bases, and more.	$ 29
MDMS—EDUCATION SYSTEM. Easily create your own quizzes and tutorials with built-in grading.		$ 29



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MDMS—INVENTORY Updates, editing, item search, summary report and more.		$ 29
MDMS—PAYROLL Complete employee records including earnings and all tax deductions.		$ 29
MDMS—MAILING LIST Enter, delete and print out.		$ 29
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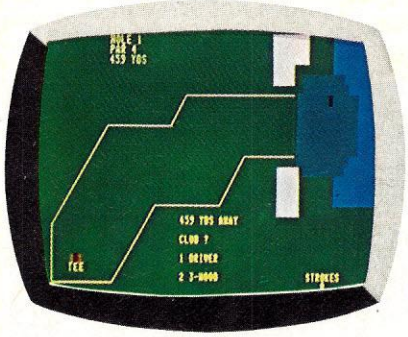
*OS-WP2 full word processing on a mini-floppy.		$200



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*GD8	(Joystick systems only) Zulu 9, High Noon, Star Wars, Bomber, Surround.	$ 29
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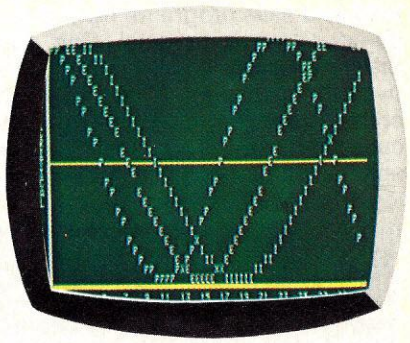

Personal Programs

PD1	Annuities, rate of return, biorhythm, calorie counter, checking and savings.	$ 29
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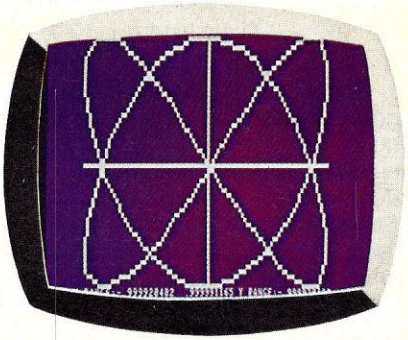

Utility Programs

65D	Aux. 1 Resequence, BASIC disassembler, memory test, sort and more.	$ 29
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*Not available for C1P MF.

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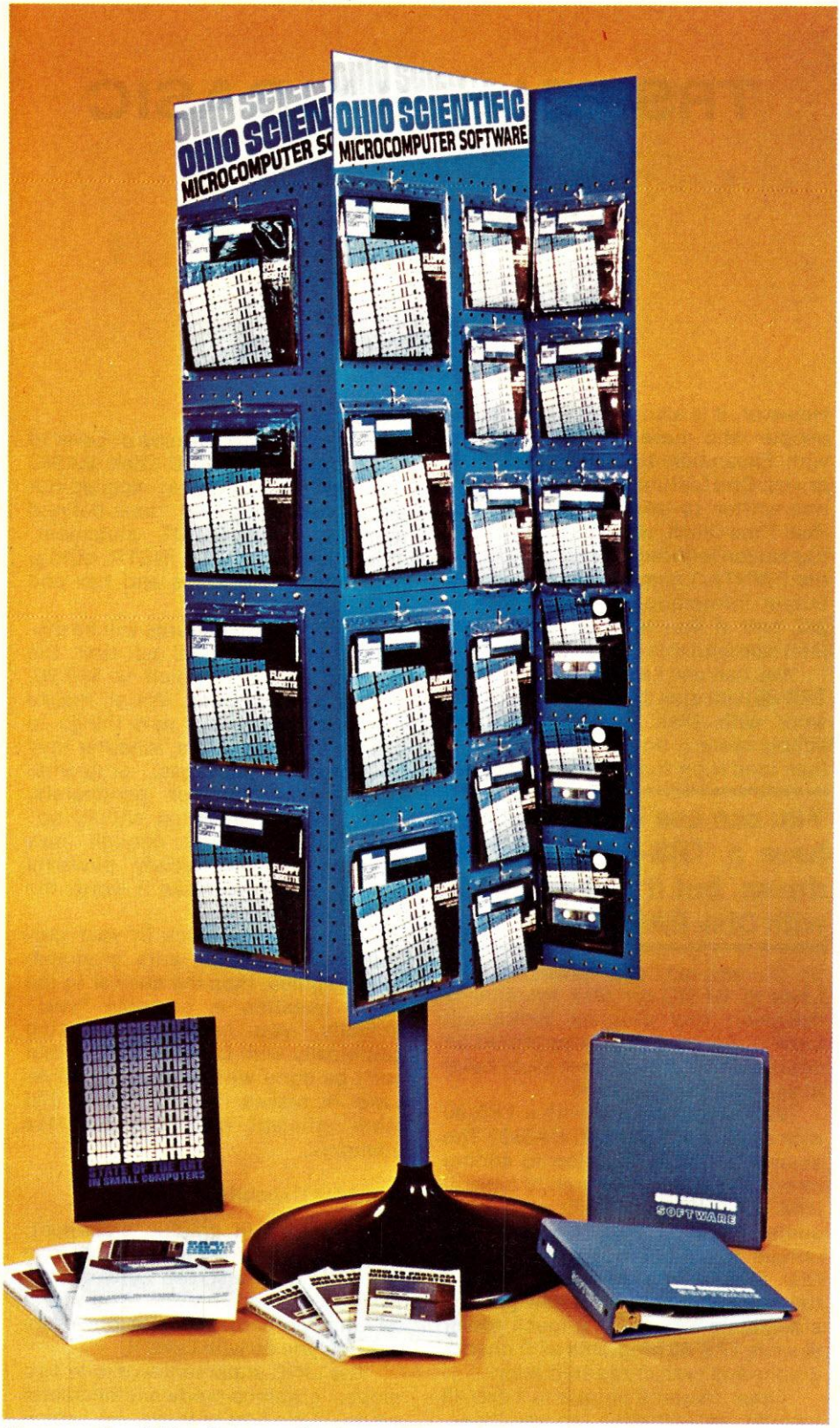
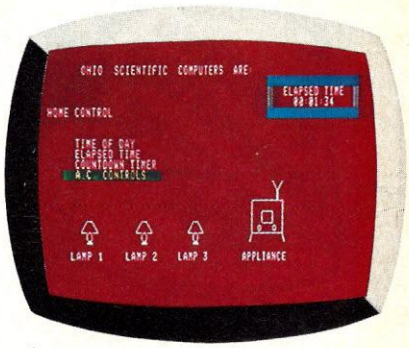


Close to 2 million bytes of software available!



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*Not available for C1P MF.

to be continued, continuously!

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CIRCLE 177 ON READER SERVICE CARD

TRS-80 Level III BASIC

David Bunnell

My Level II TRS-80 Computer with 16K RAM memory has more power than any other Level II TRS-80 Computer with 16K RAM in the world! But since this will be short-lived, I want to tell you about it now while it lasts.

The secret to my powerful TRS-80 is that its Level II BASIC has been "enhanced" by a new software package called Level III BASIC. Written by Microsoft, the same company that wrote Level II BASIC, Altair BASIC, PET BASIC, Applesoft BASIC and several others, Level III BASIC comes on cassette tape and takes 5.2K of RAM memory. It was previously sold under the G2 label from GRT Corporation but since they've gone out of business it is now being sold by Microsoft Consumer Products for $49.95 (10800 N.E. 8th, Suite 819, Bellevue, WA 98004). One of their dealers is Lifeboat Associates, 2248 Broadway, NY, NY 10024.

I'm a free-lance writer who was fortunate enough to write the instruction booklet for Level III. I virtually "lived with" Level III BASIC for six weeks and I'm anxious to let other people know what I found out about this new software.

But before I go on, let me assure you that while I am enthusiastic about Level III, I am not writing this as a favor for anyone. In fact, I have some critical observations to make that Microsoft would probably rather not be included.

System Requirements

Level III BASIC was written primarily for TRS-80 Computers with Level II BASIC and 16K RAM memory. However, it is also being marketed to people who have TRS-80 systems with Expansion Interfaces and disk drives. One feature, the TIME$ string, was written to take advantage of the Real Time Clock, which is a part of the Expansion Interface. Another feature, the PRINT#-3 command, will let you output information through the RS-232 port if you have an Expansion Interface with this option.

You can use Level III if you have a TRS-80 with disk drives, but it will not work with Disk BASIC. You can simply store it on disk as a file and then load it on top of Level II BASIC.

You can use Level III if you have a TRS-80 with disk drives, but it will not work with Disk BASIC.

So be advised, the advantages of Level III BASIC for disk systems is marginal. Any program written in Level III BASIC can only be stored on cassette tape. You cannot store Level III programs on your disk.

Why would anyone with a TRS-80 disk system buy Level III BASIC? The answer is that in addition to adding many Disk BASIC features to Level II BASIC, Level III BASIC also adds some features that are currently unique to both Level II BASIC and Disk BASIC. The most important of these are some powerful new graphic statements that make it much easier to write TRS-80 programs with charts, graphs and even crude animation.

Other features unique to Level III include: renumbering program lines, single-stroke instructions, new SAVE and LOAD commands and the option of setting a time limit for responses to INPUT prompts.

The remaining features of Level III BASIC are all TRS-80 Disk BASIC features. They include: spelled-out error messages, 10 user-defined routines, LINE INPUT statement, more flexible MID$, INSTR string, user-defined functions and hex and octal conversion.

Most of these features will be discussed in more detail, but first, the price of Level III, which is $49.95, should be mentioned. We all realize that there are always new things to buy for our computers, whether they be software packages, programs, hardware options, or peripherals. Therefore, the question should be: Does Level III add enough new capability to an already powerful Level II BASIC to make it worth the investment?

If you like graphics in your programs and want to write programs with graphics, then the answer to the above question is probably "yes." Actually, you can't do anything graphically with Level III BASIC that can't be done with Level II, however Level III makes it much easier and more efficient (you use up less memory).

Graphics Capability

The Level III graphic statement, LINE, lets you draw either a line or a rectangle on the screen between any two designated points. You don't have to methodically plot out every point as you do with Level II.

The LINE statement works in two modes, graphics mode and character mode. In the first of these, the screen is divided into a grid that is 128 across by 48 down. In character mode, the resolution is not so fine (64 by 16), but

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Level III, con't...

motion across the screen is much faster. Character mode also gives you the option of drawing on the screen with alphanumeric characters or any of Level II's graphic characters (remember the CHR$ string?).

In addition to the LINE statement, Level III also adds a GET @ and PUT @ statement. These statements let you save a graphic array (called GETting an array) to be put back on the screen at any designated position (called PUTting an array). These statements greatly simplify the procedures for writing programs with animation. They can also be used to save the format of charts or graphs which you might want to display on the screen at different times with different numbers or labels.

My main complaint about Level III graphics is the same as my complaint about Level II graphics, which is the screen just doesn't give you fine enough resolution. Try generating a circle and you'll see why higher resolution is more desirable. Only the crudest figures can be drawn with Level III.

Renumbering and "Single-Stroke" Capabilities

One of the concepts behind Level III BASIC is that it has enough features so that there is something for just about everyone. It may or may not really accomplish this goal. The next most important feature after graphics is renumbering program lines. If

You can't do anything graphically with Level III BASIC that can't be done with Level II, however Level III makes it much easier and more efficient.

you've done much programming at all, you'll like this one. The Level III instruction for renumbering program lines is the NAME command. It is a flexible command, one that demonstrates the level of care for the user that has gone into most of Level III.

Using the NAME command, you can renumber program lines beginning at any location in the program. The chosen location can have any designated line number as long as it is greater than the previous line number. And, the following line numbers can be incremented by any number, as long as you don't go beyond 65,529.

One more thing; the NAME command automatically updates all the line number references following GOTO, GOSUB, THEN, ELSE, etc.

Some people feel that single-stroke instructions are the most important features of Level III BASIC. Actually, "single-stroke" is somewhat misleading and in deference to this, the Level III manual refers to them as "Shift-Key Entries." By pressing the SHIFT key and one of the letter keys (A-Z) you can enter an instruction, command, or any string up to 15 characters into the computer. In other words, instead of typing LIST and pressing the ENTER key each time you want to list a program, you can simply enter SHIFT L. To run a program, you simply enter SHIFT R.

Level III maintains a list of 26 Shift-Key Entries, but the really important thing is that they are user changeable. By using the new LSET command, you can change the Shift Keys to anything you want, including commonly used INPUT responses. And, just in case you ever figure out how to modify your TRS-80 for upper/lower case, you can turn the Shift-Keys off by typing LSET RESET and pressing ENTER. The command for turning them back on is LSET SET.

Strings and Other Things

Level III BASIC expands the use of INPUT statements in two important ways. First, by using the new statement, LINE INPUT, your program will accept inputs that include commas, quotation marks, dashes and all other punctuation marks. Also, LINE INPUT eliminates the automatic question mark (?) prompt. If you want a question mark, you simply include it in the prompt string.

The other way in which Level III expands the use of INPUT statements is with the addition of #LEN. By adding this to INPUT (INPUT#LEN) you can put a time limit on responses to INPUT prompts. This will be a very helpful for education and game programming. For example, you could write a math drill program that gives students ten seconds to work out each problem before going on to the next problem.

String manipulation power is increased in Level III BASIC with the addition of the INSTR function and the expanded use of MID$. INSTR, which is also found in Disk BASIC, allows you to search a string for a specified substring. For example, you could search a list of telephone numbers for numbers that have the 212 area code. MID$ can be used on the left-side of the equation in Level III as well as the right-side of the equation. This feature, too, is found in Disk BASIC.

Level III BASIC even corrects some of the problems with Level II BASIC. It eliminates keyboard bounce and provides more reliable cassette tape loading. Two new commands, LOAD and SAVE replace the Level II CLOAD and CSAVE commands. They permit cassette tape

One of the concepts behind Level III BASIC is that it has enough features so that there is something for just about everyone.

interfacing without the usual "volume sensitivity" of the tape recorder.

As with TRS-80 Disk BASIC, Level III BASIC spells out the error messages instead of displaying two letter abbreviations. Instead of getting the error code NF, you get the error message, NEXT WITHOUT FOR. This greatly simplifies debugging because you don't waste time referring to the error code chart.

With a TRS-80 Expansion Interface, you can make use of the Level III string function, TIME$. It can be used like any other string function to add a built-in digital clock and calendar to your computer.

Upon loading, TIME$ is set to all zeroes (0), and it begins working automatically. You can easily set it to the correct time and date, then use it to time various program activities, or to perform calculations where time and date are essential.

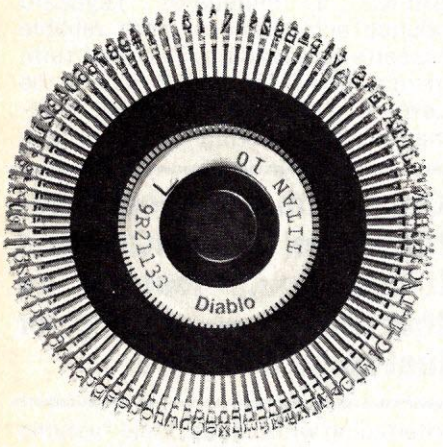
With the optional RS-232 port, then you can use the new statement, PRINT#-3. This allows you to output information through the RS-232 port to control line printers, LED's, stepping motors, lights, or whatever.

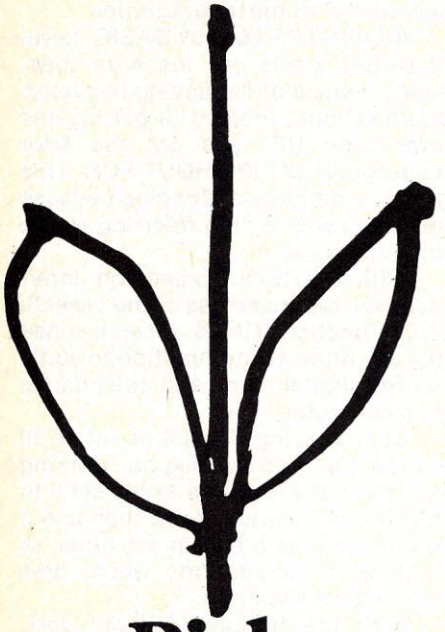
For those sophisticated enough to be using machine language subroutines in their programs, Level III simplifies exit to user subroutines with automatic conversion of Hex and Octal Constants. It also allows 10 user defined routines, as compared to one in Level II BASIC.

Summary

In addition to the features of Level III BASIC, many people will appreciate the way in which it has been

When you set your standards high,





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documented. The instruction booklet is based on extensive documentation written by Microsoft's Andrea Lewis. It was written for people who have some programming experience, but the user doesn't have to be an expert to understand it. Examples and sample programs are abundant.

One apparent result of the care that has gone into Level III is that on the whole it is a more professional package than Radio Shack's Level II BASIC. It's hopeful that this effort pays off and that software to follow will equal or exceed GRT's standards.

Level III BASIC even corrects some of the problems with Level II BASIC. It eliminates keyboard bounce and provides more reliable cassette tape loading.

Now for some of the negative observations promised earlier. To begin with, Level III wouldn't be necessary if it weren't for some apparent shortcomings of Level II BASIC, which was also written by Microsoft. The problems with loading and saving programs on cassette tape (CLOAD and CSAVE) are particularly irritating. Why didn't Microsoft and Radio Shack see this problem and correct it? It seems that too many companies are always in too big a hurry to get product out. Level II BASIC probably should not have been released in the first place with these problems.

While Level III BASIC can be stored on disk as a file, it can't be used with Disk BASIC. It's hard to imagine that many Disk users will want to give up the use of file commands. Actually, Level III probably shouldn't be marketed to Disk BASIC users at all. Instead, a disk version of Level III with the neat graphics statements and other unique features should be planned for the near future.

One more concern is the 5.2K RAM memory that Level III requires. Granted, this isn't very much when you consider all the new features, but a TRS-80 without an Expansion Interface can only have a maximum of 16K RAM. Many TRS-80 programs written in Level II BASIC, including those marketed by GRT, take more than 12K RAM. You won't be able to take advantage of LEVEL III's new LOAD command for these programs.

As I said, you have to weigh the advantages of Level III against the cost. The decision is yours. □

Example of Level III BASIC Graphics Program*

The following program is a Level III graphics program that uses the three new graphic statements, LINE, GET and PUT. It generates the image of a rocket ship and makes it move up the screen. It was written in graphics mode.

Program	Explanation
10 'ROCKET IN GRAPHICS MODE	Remark
20 CLS	Clear Screen
30 LINE (3,1) - (3,2), SET	
40 LINE (2,3)- (4,4), SET, BF	Draws Rocket
50 LINE (1,4) - (1,5), SET	
60 LINE (5,4) - (5,5), SET	
70 DIM A% (2)	Dimension Array
80 GET (1,1) - (5,6), G, A%	GETting Array
90 CLS	Clear Screen
100 FOR Y = 42 TO 1 STEP -1	So rocket will start at bottom of screen and move up
110 PUT (1,Y) - (5, Y + 5), SET, A%	PUTting array on bottom of screen
120 NEXT Y	Creates movement
130 CLS	Clears screen
140 GOTO 100	Let's do it again, and again, and again...

*This example is from the Level III Instruction Booklet.

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PET Software From Creative Software

Randy Heuer

Creative Software is one of several companies currently producing software for the Commodore PET. Like most companies producing software for the popular microcomputers today, their selection consists primarily of games and a few personal applications packages.

Each cassette from Creative Software comes in a hard plastic box packaged in a 5" x 11" plastic ziplock bag. Some of the packages contain a two page instruction sheet, however, others contain just the instructions contained in the programs themselves. We feel it would be desirable to have some written documentation for every program.

Some of the software requires the use of the dual joystick interface available from Creative Software. This little module plugs into the PET's parallel user port and costs $45, less the joysticks. You may use the joysticks from an Atari video game or purchase them from Creative Software for $12.50 each. These prices may seem a bit steep, but the joysticks do add much to the games. The interface module comes with two programs and instructions for using the joysticks in your own programs.

Trap

The game TRAP will remind most people of the arcade game "Blockade." Two players can compete against each other or one player can play against the PET.

You must have the joystick interface available from Creative Software in order to use this program. Each player controls a moving blip that leaves a trail behind. The object of the game is to force your opponent to run into either the edge of the board or the trail of either player. You may direct your blip up, down, left or right by moving the handle of the joystick in the appropriate direction.

A good player will be able to beat the computer most of the time although kids will probably enjoy competing against the PET.

Breakout

Breakout is one of the most popular arcade games. This machine language version for the PET is a fast moving and enjoyable version.

Only one player can play the game at a time although players can take turns trying to accumulate the highest number of points. You may use either the keyboard or joysticks to control the paddle located at the bottom of the screen. The paddle is used to bounce a ball up to the six rows of bricks at the top of the screen. The object of the game is to try to remove all the bricks from the wall. Each time you hit one of the bricks with the ball, that brick will be removed and you will receive a certain number of points, depending upon its row.

This is a very addictive game which both children and adults will enjoy. ($10)

Seawolf

Obviously inspired from another popular video arcade game, Seawolf puts you in the role of a submarine commander. In this real-time game, you must sink as many enemy ships as possible in the time alotted. Three different types of enemy ships move back and forth across the top of the screen. You may move your submarine across the bottom of the screen and fire torpedoes by using either the PET keyboard or a joystick.

This machine-language version is extremely fast moving, perhaps a bit too fast for some as the ships and torpedoes go flying by. The game also features floating mines (that sink when hit) which block your torpedoes and ships. This is a good exercise for developing hand-eye coordination. ($10)

Life

Life is the classic computer simulation of successive generations of a population. This PET version uses a machine language routine to rapidly change generations in about one second.

Special features in the program allow the user to change and create new patterns anytime during a run. The program also incorporates some extensions into the classic routine by allowing for fixed "posts" and "holes." These features remain constant throughout a run.

Most Life "fans" will find this version very interesting with its rapid pattern changes and editing features. The only small complaint we would raise is that due to the small size of the PET's screen (40 x 40 characters), complex patterns often wrap around on themselves. Other than this, the program is excellent. ($20)

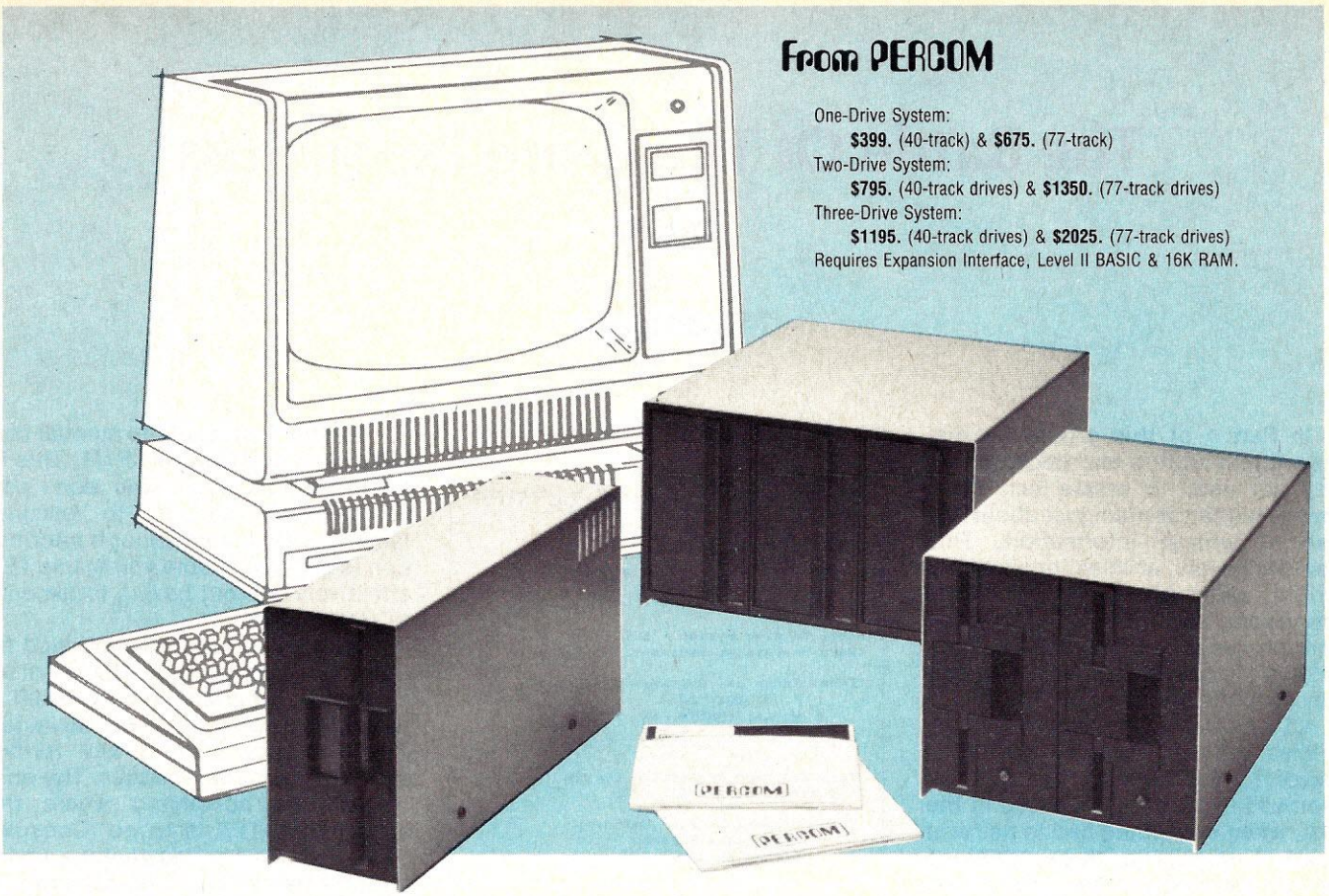
Household Finance Package

This package consists of two programs designed to record and analyze financial patterns in the home.

The programs make use of cassette data files to store monthly records of income and expenses. You create one cassette file for each month by using the first program. Each expense is classified in one of 16 different categories such as taxes, food, clothing, etc. For each expense or payment, you enter the date of payment, category code, amount, method of payment and a brief description. This information is stored on cassette for use by the second program.

The financial analysis program uses the data files created by the first program to provide an analysis of your income and expenses. First a summary of your monthly expenses by category is displayed. Next, a very nice graphic chart of your expenses can be displayed. Another month's data tape can then be entered in order to obtain a summary over several months. ($15)

For more information, write Creative Software, P.O. Box 4030, Mountain View, CA 94040. □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The Battle Of The Word Processors

Part II

Rod Hallen

In Part 1 of this article we discussed text editors and decided that they are used to create text files. These files can contain just about any kind of written information. This includes letters, articles, book manuscripts, assembly language source listings and even BASIC listings. I use word processing for business letters so I can study and revise them before they go to the printer.

Of course, all of my magazine articles pass through my word processor. In fact, I believe that this has improved my writing. Whereas in the past, when everything had to be hand typed, I might do three revisions before I got tired and accepted what I had; I now do as many as 10 revisions because the whole process is so much easier and faster. The final copy sent off to the editors is also more professional looking because it does not contain any erasures or strike-overs.

In part 1, we created and stored a text file on disk. In its present form, it isn't of much use to us. We can read it on the screen and do another revision if necessary, but hard copy is the real reason we sat down at the computer in the first place. Using the CP/M TYPE command we can list the file and the printer will make a copy that contains all of the information the file contains.

However, there is a better way to put the file on paper. A word processor will format the text so that it is more attractive and easier to read. It will break the text into pages, number and title the pages, indent and space and justify. All of these features are especially useful if you want to photocopy the prinout and assemble the pages into a book.

The word processors that we'll discuss are capable of doing all of these things and much more. Again, this will be a comparison of Digital Research's TEX and TSC's PR with Michael Shrayer's Electric Pencil used as a benchmark (see Table 1 for prices and ordering info).

Rod Hallen, Road Runner Ranch, P.O. Box 73, Tombstone, AZ 85638.


```
Text Editing System - ED
     Comes as a component of the CP/M DOS
Word Processing System - TEX  $75

From: Digital Research
      P. O. Box  579
      Pacific Grove, CA 93950

- - - - - - - - - - - - - - - - - - -

Text Editing System - EDIT  $40
Word Processing System - PR  $50

From: Technical Systems Consultants
      P. O. Box  2574
      W. Layfayette, IN  47906

- - - - - - - - - - - - - - - - - - -

Text and Word Processing System
- Electric Pencil II  $250

From: Michael Shreyer Software
      1253 Vista Superba Drive
      Glendale, CA  91205
```

Table 1. This is a source and price list. There are a great many versions of each of these programs available. Contact the software houses listed for more information. TSC also has MC6800 versions for sale.

TEX From Digital Research

The first thing I noticed about Digital Research's TEX is the manual. I think it contains some of the best software documentation that I've seen. If their CP/M manuals had been written as well, I would have been able to get into CP/M much quicker than I did. I especially like the way the various print values are described. Each has a page of its own. Example inputs and outputs are given so you can see the result of using each command. Table 2 is a summary of TEX commands.

```
Adjust Margins              Begin Page
Break                       Center
Conditional Page            Double Space
Heading                     Heading Margin
Ignore                      Indent
Literal                     Line Length
Line Spacing                Margin, Bottom
Margin, Top                 No Adjustment
Omit Page Numbers           Page Advance
Page Length                 Page Number
Page Offset                 Paragraph
Quit Indentation            Space n Lines
Single Space                Temporary Indent
```

Table 2. This is a list of the commands available to the TEX user. They are entered into the text file as required and TEX uses them to format its output file or hardcopy.

Another feature of the manual that I like is an overview of CP/M. This is for those TEX users who don't use CP/M often enough to become familiar with it. Just enough information is given to enable you to use TEX effectively without having to become a CP/M expert.

TEX uses a text file generated by ED (or EDIT) as its input. TEX is not an interactive program. Once you tell it which file to work on, it will do its job and then exit without any further attention from the operator. The only options are specifying where the output from TEX is to go (Console, Disk, Printer, or nowhere), where error messages are to go (Console or printer) and whether you are using continuous fanfold paper or single sheets. In the latter case it will stop after each page to allow you time to change sheets.

The first thing I noticed about Digital Research's TEX is the manual. I think it contains some of the best software documentation that I've seen.

When TEX is entered, it assumes certain default print values. These are set up for a standard 8½ x 11 inch page and will be entirely adequate in many cases to produce the type of printed output you desire. However, each of these print values such as margin, line length, page numbering, line spacing and many other variables can be changed at will.

This is accomplished by entering TEX print values into the file while it is being created. For instance, suppose that in the middle of the text you want to change the left margin from 8 spaces to 12 spaces and the line length from 64 characters to 56 characters. You'd enter .PO +4 LL -8 at the point where the change was desired (a command or string of commands must be preceded by a period). You can change the print values as

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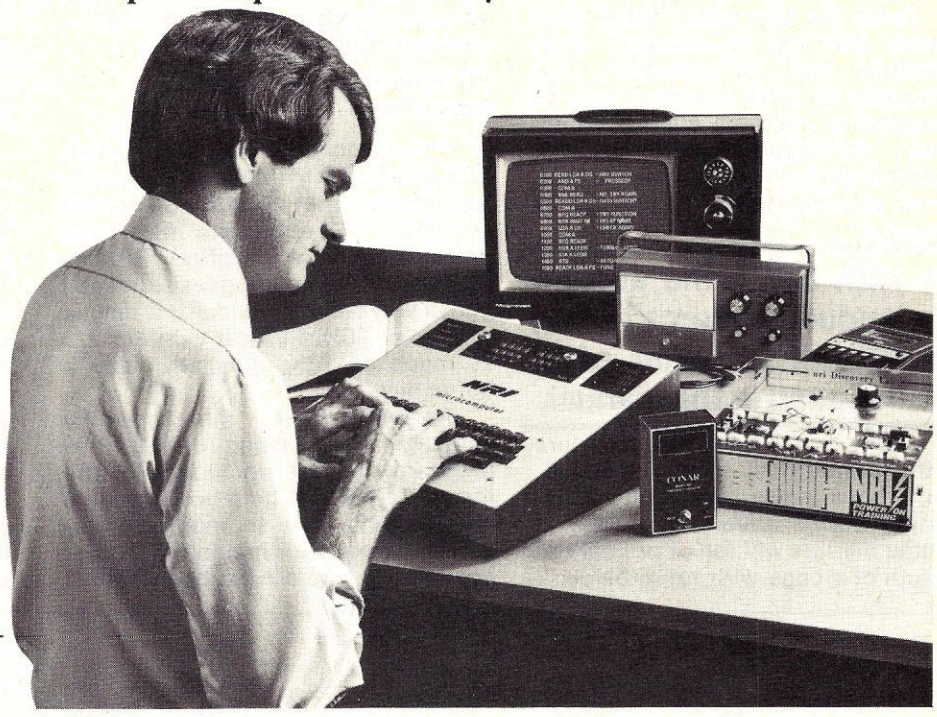

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Word Processors, con't...

many times as you like during the course of creating a text file.

Print values can be temporarily changed to leave space on a page for a picture or drawing and then changed back to the previous settings. It is possible to format the output in an almost infinite variety of ways. The final result is completely in your hands.

There are also many other print values that can be invoked. Page headings can be specified, the sequence of page numbers can be changed or numbers eliminated entirely, paragraph indenting used, right margin justification used or not, a new page started and titles can be centered.

As with EDIT, the assembly language source listing for PR, all 99 pages of it, are included in the manual.

One interesting and useful feature is the Conditional Page command. Many times a new paragraph or text section will be titled and when it is printed the title will fall at or near the bottom of a page with room below it for little or no text. The text would then continue on the next page. The Conditional Page command allows you to specify how many lines must remain for the new paragraph or section to begin with, otherwise an eject to the next page will take place before it is started.

The manual finishes up with a series of appendices which summarize the commands and default values, run-time parameters, error messages, and provides examples of various paging options. All in all, a very good piece of software.

PR From Technical Systems Consultants

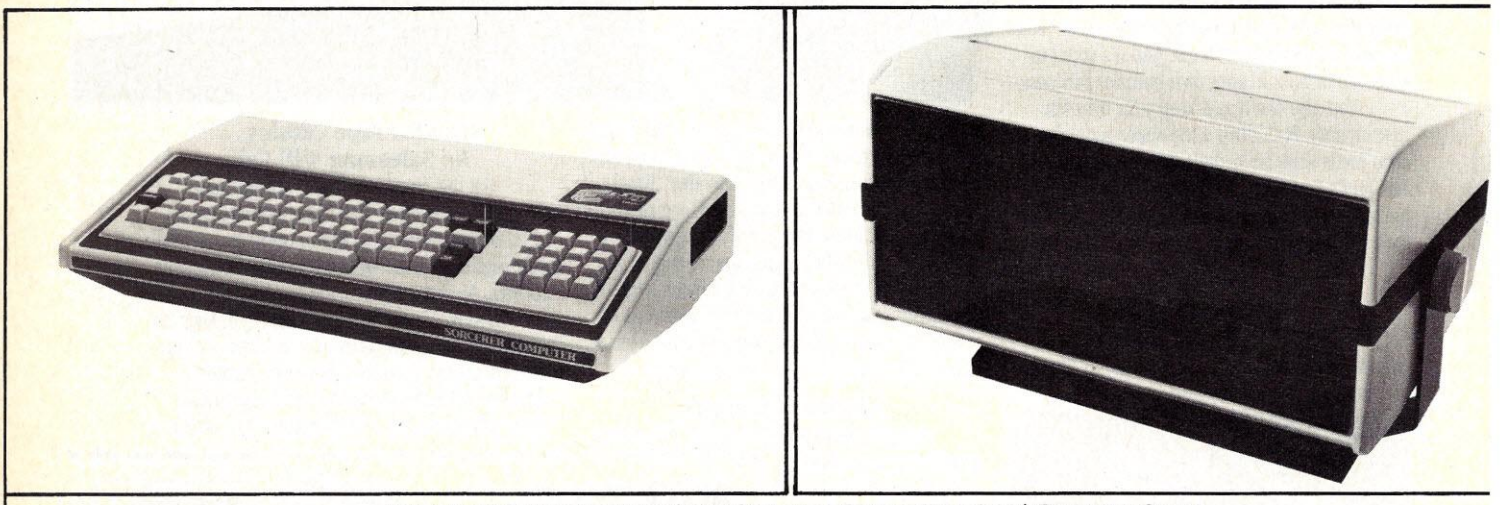
I won't go into the features that TEX and TSC's PR have in common; just assume that everything I've told you about TEX applies to PR as well unless otherwise specified. PR has many other outstanding features and I guess you could consider it a deluxe version of TEX. Since it sells for 2/3 as much as TEX, it is obviously a better buy.

As with EDIT, the assembly language source listing for PR, all 99 pages of it, are included in the manual. This will help you software hackers who have to modify everything you get your hands on. Again, however, it would have been nice if this had also been put on the system disk. It is also a very well-written manual.

When PR is first entered it will ask you the date, which can then be used in later text processing. Next, it will ask you whether you want output routed to printer or disk and, if you select disk, it will ask for a file name. It will also ask you if you want to echo the file to the CRT while it is being

Append to Macro	Arabic Numbers
Set Trap	Set Auto Increment
Break	Center Lines
Close Data File	Change Trap Location
Capitals ON	Capital Roman Numerals
Divert and Append	Divert Text
Define Macro	Exit Processor
Fill Lines	Get Info from Term.
Set Item Character	IF True, DO
Indent	Justify
Left Margin	Right Margin
Title Length	Multiple Spaces
Next Block	No Capitals
No Fill	Next Item
No Justification	Need Lines
Number Register	No Space
Open Data File	Output Saved Lines
Eject to Next Page	Put String in Indent
Page Length	Page Number
Pass Text	Read Item
Remove Macro	Repeat File
Restore Spacing	Single Indent
Space Lines	Small Roman Numerals
Single Space	Stop
Suppress Blanks	Save Lines
Set Tabs	Set Tab Character
Tab Fill Character	Define Title
String to Term.	3 User-defined commands

Table 3. A list of the directives available to the PR user. These commands and those shown in Table 4 for TEX are only the beginning of the big picture. Most commands allow modifiers which increase their flexibility and power.



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Exidy inc.

#1

output. These are similar to the TEX run-time options handled in a slightly different manner.

Printing two columns per page is possible but you must roll the paper back to the beginning of the page for the second column because negative line feeds are not supported. You can preset a given number of nulls to be output after each carriage return to give your printer time to return to the left margin if necessary.

You can also select a specific block of pages to be printed. If you respond "10,16" to the question "Page Limits," the entire file will be processed, but only pages 10 through 16 will be printed. Another command allows you to pass a file from input to output exactly as it was written. The printed copy would then contain all commands and comments.

PR does not startup with many standard print values and the first few lines of every text file must contain the print values that you want implemented. From then on these values can be changed during text processing.

While text files intended for use by PR or TEX can be written with either ED or EDIT, files written for one word processor cannot be run on the other. This is true because the commands for each of the processors are completely different although they may in the end accomplish the same thing.

PR supports many commands which are normally available only on much larger computers. The list is long and I won't be able to cover them all here in any detail but most of them are listed in Table 3. The command summary in the manual is four pages long. I went through the summary and added page numbers to all of the commands so they are easier to find.

The first command which struck my eye were those used to print page head, foot and number information. These can be at the top or bottom of the page and they are very flexible. The page heading, for instance, can be made up of one, two, or three parts. The first part will be left justified, the second part will be centered and the third part will be right justified.

Justification can be specified as left, left and right, or centered. A centering command also allows the centering of a stated number of lines.

The capitalization mode is very interesting. It is designed to be used on a terminal that is uppercase only. All characters are then sent to the printer as lowercase except those which are preceded by the "@" symbol. The "@" is used just like a shift key and the "↑" is used as a shift and lock key.

The macro capability of PR is outstanding and probably its best feature. Strings of commands can be identified by a two letter name which is then used in place of these commands whenever required. For example, a header macro could be devised that would provide special header formatting and then its name would be invoked whenever it was needed.

The macro capability of PR is outstanding and probably its best feature.

If you want a macro to be implemented at a certain line on every page, a trap is used. A trap identifies the desired line number and calls the specified macro each time that line number is reached. One benefit derived from using macros is the ease of changing them. If you decided to change the number of spaces after th the header on each page, you'd change the space value in the macro instead of going through the text and changing each appearance.

At the end of the manual is a macro library. This contains many useful, and sometimes complicated

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CHAR/Line	64	32	40	40	64	40	64/32
Line/Screen	30	24	24	24	16/32	25	16
Graphic Resolution	512/240	192/256	380/192	280/192	128/128	320/200	128/48
Keyboard	79 Key Typewriter	40 Key Calculator	57 Key Typewriter	52 Key Typewriter	77 Key Typewriter	73 Key Calculator	53 Key Typewriter
Lower Case Standard	Yes	No	No	No	No	No	No
Numeric Keypad Standard	Yes	No	No	No	Yes	Yes	No
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System Software Available	ROM Basic ROM Assembler ROM Word Processor CPM EXT. Basic CPM Fortran CPM Cobol CPM APL CPM Pascal	ROM Basic	ROM Basic ROM Assembler	ROM Basic Disk Basic Pascal	Disk Basic	ROM Basic Disk Basic	ROM Basic Disk Basic Cassette Assembler

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macros. It is possible to set up the entire formatting for a book in macros and then just call each one as required during the processing of the text by embedding the name of the macro in the text.

Another extremely powerful feature of PR is the IF command. IF is used in a fashion very similar to the way in which it is implemented in BASIC. Printing a Book? IF can be used in a Macro to left justify the heading on even numbered pages and right justify it on odd numbered pages. That is a simple example; IF can test many conditions and then call one or more PR commands or macros.

When the value of any register, including the page number register, is printed out, it can be in Arabic, large Roman, or small Roman numerals.

Also reminding me of a BASIC program are the Number Registers which are similar to BASIC's variables. Some registers are system registers which keep track of various print values and parameters. The rest of the registers are user-definable and these can be used for any purpose desired. Once set the user-definable registers can be auto incremented in steps of any specified value. The IF command can test any register and then act accordingly. When the value of any register, including the page number register, is printed out, it can be in Arabic, large Roman, or small Roman numerals.

PR is the only word processor I have encountered that supports operator communications. It is possible to insert messages to the operator in the text file, which are printed on the screen and then the processor stops. It is restarted by hitting any letter on the keyboard.

One example of the usage of this feature would be in single sheet printing. PR prints one page, displays the message "Insert new sheet of paper in the printer" and stops. The operator complies and then restarts the processor. This would continue for each page. This could also be used in the double column printing mentioned earlier.

The processor can also get information from the operator. Each time the Get Info command (very similar to BASIC's INPUT statement) is encountered, a message is printed on the screen and the processor waits for input. That input is inserted in the text at the point of the Get Info command. An example would be text which is a form letter with a Get Info command in place of the date, name and addresses. Using the repeat command the letter can be typed automatically a large number of times with the operator inputting the appropriate information for each letter.

A data file can also be set up much in the same manner as BASIC. This data file could contain names and address, telephone numbers, policy numbers, expiration dates, or any other desired information. It can be read one item at a time and the data obtained used in the form letter mentioned above. The possibilities are endless.

I have never come across a microcomputer word processor that made provisions for footnotes. PR handles these perfectly. If, during the creation of the text, you feel the need for a footnote, you enter the footnote following the reference to it and the footnote will be printed at the bottom of that page. If the footnote is too large to all fit on that page, it will be continued to the bottom of the next page.

And last, but by no means least, is a function called "Environmental Control." This allows you to set up two completely different page formats and then change from one to the other at will. You could, for instance, format the left hand page margins differently than the right hand page margins all the way through a book to compensate for binding. Again, this is very flexible and under your complete control.

In the space available to me here it has been impossible to do more than touch on what I consider to be some of the best word processor features I have ever seen. PR is, without a doubt, the most powerful of the three word processors discussed, and I don't believe in using the word "powerful" carelessly.

I have never come across a microcomputer word processor that made provisions for footnotes. PR handles these perfectly.

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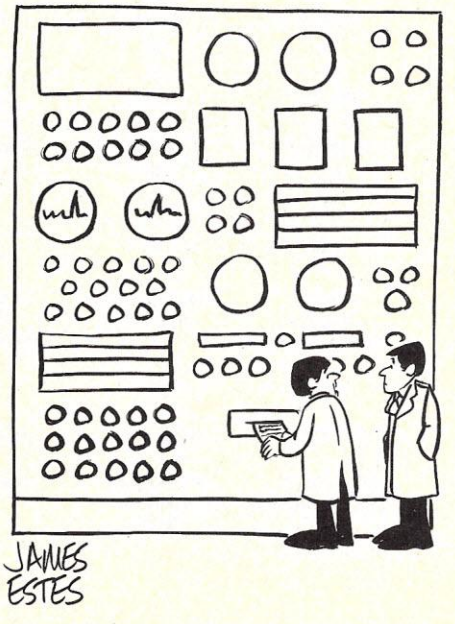

"It says, 'That's for me to know and you to find out'."

Conclusions

All of these word processing systems will run within a 16K version of CP/M. This will limit the size of the text buffer somewhat but this is only critical with the Electric Pencil which requires that the entire text file reside in memory during editing and processing.

I mentioned earlier that Electric Pencil files were not compatible with ED, EDIT, or the CP/M assembler. I know of two conversion routines that will convert Pencil files to CP/M files and vice-versa. One is available from Shrayer Software and the other is featured on page 26 of the March 1979 issue of Dr. Dobb's Journal.

I am using the latter and it works very well on assembly language source listings. I've tried to convert text files but extra carriage returns seem to be getting into the text. I think this is caused by text lines which are longer than 80 characters. I plan to reassemble the routine with a larger line buffer and see if that solves the problem.

One improvement I would like to see made to the Pencil would be a choice of CP/M or Pencil format at the input/output level. This would eliminate the need for a separate conversion routine and would be much more convenient.

Table 4 is my opinion of the cost effectiveness of various combinations of editor and processor. I haven't included TEX in any of the combinations because PR is better and cheaper. ED - PR is the lowest

Word Processors, con't...

```
Low cost choice - ED + PR = $50
Cost Effective - EDIT + PR = $90
Disregard cost - Electric Pencil = $250
```

Table 4. My choice of Text Editing - Word Processing systems. Costs on the Electric Pencil vary from under $100 to over $300 depending upon the version that you purchase. The most expensive versions support proportional spacing on a Diablo printer and these give true typewriter hardcopy. There is also a version of the Electric Pencil for the TRS-80.

priced combo and it should be satisfactory for most users. The EDIT - PR duo offers easier editing. In either case, PR offers very powerful word processing, more powerful than even the Electric Pencil provides.

Okay, if that is true, why did I use the Electric Pencil to edit and print the manuscript for this article? For the simple reason that Pencil has the easiest to use editor and I didn't need the power of PR. The Pencil is ideally suited to formatting magazine manuscripts. PR would probably by your choice if you process a lot of form letters or book manuscripts.

In either case, PR offers very powerful word processing, more powerful than even the Electric Pencil provides.

The severest limitation of the Electric Pencil is its requirement for a memory mapped video interface such as the VDM, VTI, or VIO. It will not work with a serial video terminal. I don't consider this to be a problem since I prefer memory mapped video. It is more difficult to program for, but much more versatile. I am using IMSAI's VIO which allows me 1920 (24 x 80) characters on the screen.

Text editors and word processors are very useful programs. Even if you only use them occasionally, they will improve your letter or manuscript writing. The businessman will find them indispensable. □

References

Word Processing - Creative Computing Jul-Aug 78 page 119

Electric Pencil - Creative Computing Feb 79 page 30

Electric Pencil - Kilobaud Microcomputing Mar 79 page 114

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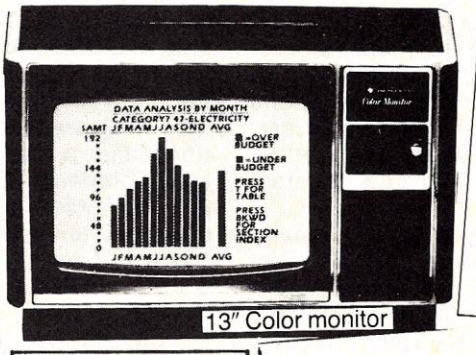

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Mountain Hardware's Apple-based Introl/X-10

A Home Control System

Paul Daro

One of the first applications of mini and microcomputers to gain widespread use was in commercial control systems. Computers were, and still are, quite useful for constantly monitoring and controlling electrical and mechanical systems. With recent developments in the microcomputer industry driving processor and peripheral costs down, we are now starting to see products that provide household computerized control. The Introl/X-10 system for the Apple Computer is one such product. It is a system for controlling an entire household of electrical appliances and devices.

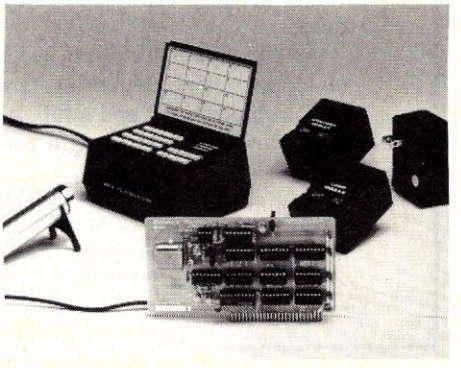
In addition to performing its control functions, certain configurations of the Introl/X-10 system allow for another feature not commonly found in home systems - simultaneous execution of two different programs. The interrupt-driven Introl/X-10 performs its control function in the upper part of Apple memory, leaving room at the bottom for the user's own program (even BASIC).

The Introl X/10 system consists of a hardware/software package. The hardware provides the interface from the Apple to the outside world; the software enables the user to set up a real-time 'schedule' for controlling AC devices. The system is complete - no further programming is necessary to make it control a house, although there is BASIC interface that allows advanced users to set up more sophisticated applications than the software package provides.

The Hardware

There are 3 basic functional units that make up the Introl system. At one

Paul Daro, 436 Trevethan Ave., Santa Cruz, CA. 95062.



end, a Mountain Hardware Introl/X-10 controller board provides an interface between Apple programs and the other 2 functional units; it sends out control commands via an ultrasonic transducer. These commands are received by the second unit, a BSR Command Console. The Command Console then transmits the commands over existing household AC power lines to the third functional unit, a BSR remote module. A single Command Console can control an unlimited number of remote modules, and each remote module controls one appliance (up to 1500 watts) or several lamps (up to 300 watts).

The Introl/X-10 circuit board can be mounted in any of the Apple II peripheral slots (except 0, of course). It has an on-board ROM program that controls the transmission of pulses to the BSR Command Console. The board is activated by the BASIC PR# command, and information is passed to the ROM program using conventional PRINT statements.

In addition to receiving Apple commands and sending them out to the remote modules, the Command Console also has a keyboard, enabling the user to send commands manually. The Command Console and remote modules are sold by BSR, Ltd. as the System X-10, a centralized electrical control system. Mountain Hardware has added the Apple peripheral board, thus facilitating centralized computer control, and creating the Introl/X-10 system.

In order to fully understand the Introl/X-10 system, one should understand how commands are sent. On the side of each remote module is a "unit code" dial. This dial has 16 different positions, numbered 1 to 16. This dial identifies the remote module. Commands are issued from the Command Console either manually or using the Introl board. They are issued by first sending a unit code and then a function code - the unit code selects the electrical device, and the function code identifies the action to take place. Suppose you sent the sequence 6, ON. Then all electrical devices plugged into remote modules with the unit code dial set at 6 would be turned on. There are also function codes for turning devices off, making lights dimmer and brighter, and 2 global codes 'ALL LIGHTS ON' and 'ALL LIGHTS OFF,' which turn all lights on or all lights and appliances off regardless of the unit code dial setting.

This simple scheme provides for alot of flexibility, as several different devices can be controlled together even though they are plugged into different remote modules - all you need do is dial up the same unit code for each and one command turns them all on. This could prove useful for controlling several outside lights located around the house, or perhaps to control room heaters in each bedroom. At the same time, the 16 different settings on the unit code dial provide the capability to independently control 16 different groups of

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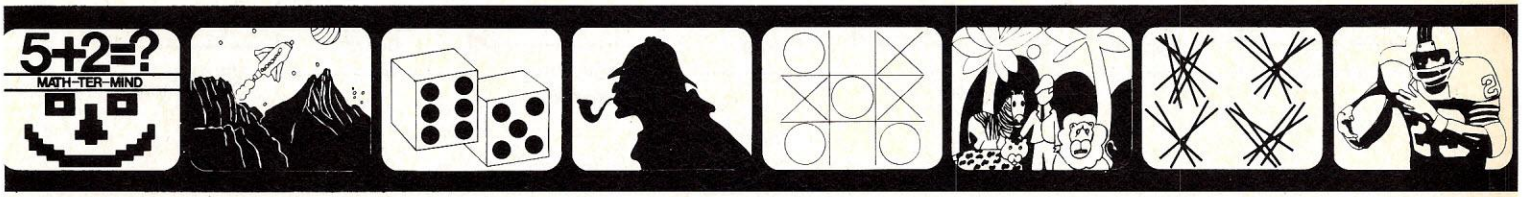

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Home Control, con't...

devices. This should be more than adequate for any home application, especially when one considers that each of the 16 groups can have an unlimited number of devices dialed to it.

The Software

So far only the rudiments of the system have been explained. The following is by far the most powerful part of the Mountain Hardware package - a software system for setting up and running a schedule of device ON/OFF/DIM commands.

With this software package, the user runs one program to set up a schedule that contains information for each device concerning what day and time the device is to be turned on, off, or dimmed. The he/she runs a second program which loads this schedule and then executes the commands at the appropriate times, allowing the individual to walk away and leave the computer running - control is fully automated from then on. This program also keeps an accumulated total of the time a given device group was turned on, and the total amount of power it consumed.

Setup Program

The schedule setup program is written in Applesoft BASIC, and needs at least 32K of RAM to run. The program uses menus to interact with the user. This makes the setup process a simple one, requiring limited prior knowledge of the setup process from the user.

Basically, there are two ways in which someone might want to set up a schedule for a given device. The first approach deals with events that occur on some sort of regular basis. For example, you want to turn the coffee pot on every weekday at 8:00, so your coffee is ready when you get up. Or, perhaps you want to turn your lawn spinkler on for 2 hours every Tuesday and Friday. These types of events occur regularly every week, and you want them to occur at the specified time as long as your computer is running. Events like these have been termed regular events.

The other type of event specification is used in cases where you want something to happen only once. For instance during the weekend of the 14th, you are going away and want some lights to come on in the evening and go off in the morning. You want your regular schedule to run all the time, but in addition, on the 14th and 15th you want some additional events to occur. Events such as these are termed special events, and the system provides a means for entering these as well. Using the setup program, the user creates a separate schedule for each module group. (A module group is the set of all remote modules dialed to the same unit.)

Running the Setup Program

When the program is first run, the user chooses between creating a new schedule and updating an old one previously saved on disk. From this point, the setup process has two principle modes - the primary or executive mode and the edit mode. In the primary mode, the following options are available:

ASSIGN - With this option, the user makes up a name for each module group and inputs the total power consumption in watts for each group. The name and wattage is then assigned to the unit code number of the module group. Unused unit code numbers may be left unassigned, but a number must be assigned before a schedule may be created for it. This option exists primarily to help the user keep track of which module group contains which devices.

DISPLAY - This option displays for all 16 groups the module group numbers, names and wattages as they were entered.

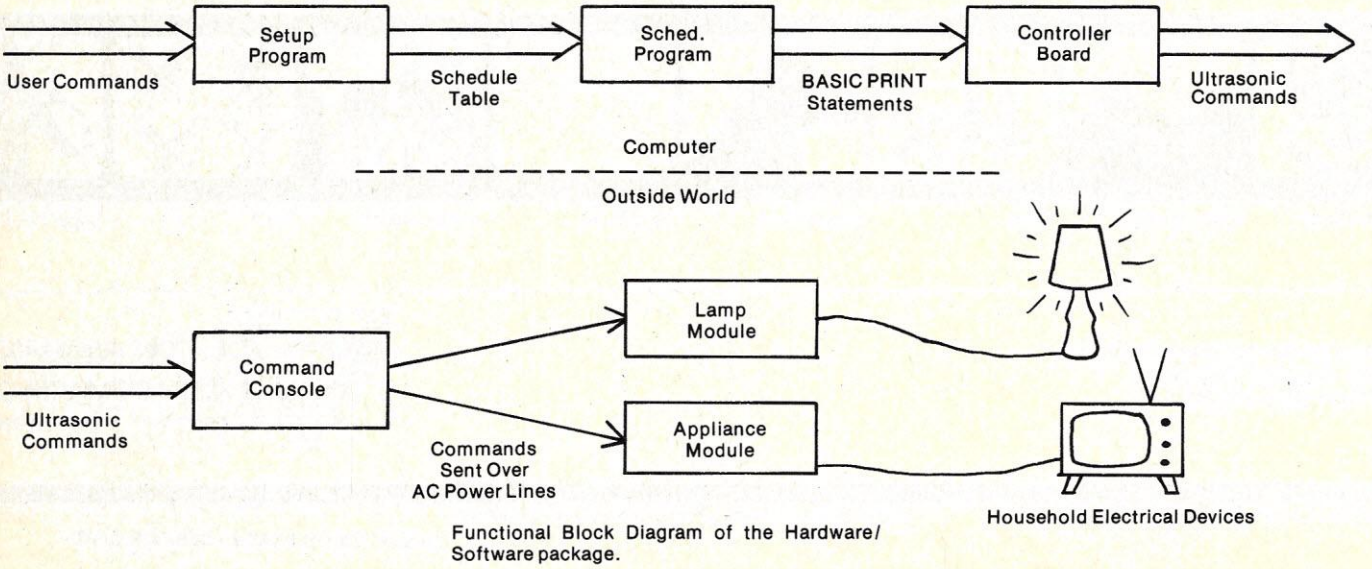
SWAP SCHEDULES - This switches the schedules of two module groups. This function is used when you switch the unit code setting on a remote - you can do the swap function to reassign the schedule, instead of retyping it.

REMOVE SCHEDULE - This deletes the schedule for one entire module group.

SAVE SCHEDULE - This saves the entire schedule table for all 16 groups onto a user-specified disk file.

COMPUTE FILE SPACE - This tells how much room is left in the schedule table, giving the user an idea of how much more schedule information may be entered.

In the edit mode, individual group schedules are modified/updated; concurrently a schedule table in memory is updated. Upon entering the edit mode, the user specifies which module group he wishes to work on. He then has the option to add events to the schedule, remove events from the schedule and display the entire schedule for a given module group.



Functional Block Diagram of the Hardware/ Software package.

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In adding events, there are different specifications for regular and special events. Regular events are specified by entering the day(s) on which it occurs, time at which it occurs and the desired function. Special events also have a date(s) associated with the event occurrence. In each case, the user is prompted for each parameter (day, time, etc.) separately.

The time parameter is specified by typing in the time much as it would be displayed on a digital clock. For example, "12:30A" would mean the 80th minute after midnight. Furthermore, there is a feature which allows specification of an event to occur randomly within a given interval. For example, if you went on vacation for a month and wanted lights turned on in the evening, you could use the random time function to have them come on at a random time between 6:00 and 8:00 every night. This helps to confuse anyone who might be staking out your house since the lights are not coming on in any recognizable pattern. This would be specified as "6:00P-8:00P."

The days parameter specifies on which days the events will happen. Days can be entered singly, separated by commas, or as a range of days, separated by a dash. For example, "MON,TUES,THU" would specify Monday, Tuesday and Thursday. On the other hand, "TUES-SAT" would be interpreted as Tuesday, Wednesday, Thursday, Friday and Saturday.

The function specification is one of three functions: ON, OFF, or DIM. ON and OFF are self-explanatory. The DIM function has a parameter associated with it; the DIM level. The DIM level is a number in the range 1 to 9, and specifies the final brightness of the light. The DIM function really means "turn on the lamp and then dim it to the given level." For example, if at 9:00 you wanted to turn a light on and dim it down to level 9 (most dim), the function would be "DIM 9." If at 9:10 you wanted to brighten it up by 3 DIM levels, the function would be "DIM 6."

Thus, a complete regular event specification consists of a time, days and a function entry. For example, to turn your heater on every morning at 8 and off at 10, two events would be entered:

```
8:00A SUN-SAT ON
10:00A SUN-SAT OFF
```

To make sure your TV was always turned off at night (for those who like to fall asleep in front of it), you might enter:

```
1:00A SUN-SAT OFF
```

Special events are entered just like regular events, but in addition there is a date specification. The date specification consists of a month and dates within the month. For example, "FEB 10-20" means February 10th through February 20th. Or "FEB 10, 12, 14, 16, 25" means February 10th, 12th, etc. So if you want your lawn spinkler to come on every Monday and Thursday while you are away in the last 2 weeks of July, the following special event entry would do it:

```
3:00P MON,THU JULY 14-28 ON
5:00P MON,THU JULY 14-28
OFF
```

By combining special and regular events, all possible needs are provided for. In the previous heater example, to keep the heater from going on while you are away, the following special event entry would do the trick:

```
8:00A MON-SUN JULY 14-28
OFF
```

In fact, even if the heater were to come on many times during a day, this one special event entry would take care of all the regular events, since a special event overrides the entire regular schedule for a given day.

The Scheduler Program

After the schedule has been created and saved, the schedule can be loaded and executed by the second program. This second program, the scheduler, performs the events as they were specified in the setup program. The first thing the scheduler does is load the table. It then turns off all connected devices and then determines the on/off/dim status of each device, bringing each device to its appropriate status. This initialization has interesting implications for Apple configurations that have the autoboot feature and a Mountain Hardware Apple Clock. Suppose you are away on vacation with your Apple at home minding the house. Suddenly, the power goes off for a few seconds, then returns. Ordinarily, the program would die and all your devices would stay in whatever state they were in until you came home. But, with an auto-boot program that executes the scheduler, this problem is alleviated. The scheduler loads in the table again, re-initializes all the devices and, presto, you are right back where you were.

"Oh, that reminds me. Our system also has a rather sophisticated file protect feature."

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In configurations without a Mountain Hardware Clock, the scheduler is interrupted once per second by the Introl/X-10 board. After the user types in the initial date and time, the scheduler keeps track of the time and date from there; so the scheduler program will work in minimally configured systems. However, the auto boot feature described above will not work because once power goes down, the scheduler loses track of its accumulated time. Then when the power comes back, there is no one around to re-initialize the time. Also, without a Mountain Hardware Apple Clock, the foreground/background feature is not available. Many foreground programs would do disk accesses and other functions that require interrupts to be turned off for periods of 1 second or more. When this happens, the scheduler would lose some of the 1-second interrupts and thus would start to lose time.

With the Mountain Hardware Apple Clock, the scheduler is capable of actually reading the date and time from the clock board. Even when interrupts are disabled for several seconds, no time is lost because the clock keeps its own accumulated time. This enables the scheduler program to run in the background, while a foreground BASIC or machine language program has primary control.

Since most of the time the scheduler is merely waiting for events to occur, there is not much of a delay in response time when running in foreground/background. However, if many events were all scheduled to happen at the same time, there might be a 10 or 20 second delay while the schedule was busy sending out commands to the devices. However, this situation would most likely occur once or twice a day if at all. Since the

Home Control, con't...

schedule table resides in memory at scheduler run-time, the setup program could be run as a foreground program. Thus, you could update the schedule while the scheduler was executing it. This gives you the convenience of modifying the currently running schedule without having to stop and re-start everything.

Memory Considerations

The software package needs an Apple configured with a minimum of 32K of RAM. A 32K system will allow a schedule that contains up to 150 events, while a 48K system can handle up to 700 events. In foreground/background mode, a 32K setup will have room enough for a foreground program of up to 18K; in 48K systems the foreground programs can use 28K. In all cases, the DOS software is left intact.

Direct Interface

For the ambitious programmer, there is an optional direct interface to the ROM driver program. Thus the devices can be controlled directly from a BASIC program. The statement below activates the board:

PR#n, n = slot number of board

Once this has been done, PRINT statements are sent to the board, which interprets them and sends them out. For example, the statement below would turn on module group 1:

PRINT "1 ON"

Using this simple interface, the sophisticated user can set up a scheduling scheme. A direct interface program might be written to work in conjunction with the scheduler program to get a combination of straightforward scheduling and more complex timing functions for special devices.

Conclusion

Overall, the system is quite easy to install and run. The setup program is very user-oriented since its use doesn't require programming knowledge and the multi-tasking feature makes the Introl /X10 an extremely flexible control system. It is also inexpensive - $279.00 buys the entire system including software, controller board, Command Console and three remote modules (additional remotes are $16.00 each). $279.00 for a practical system for computerized home control. □

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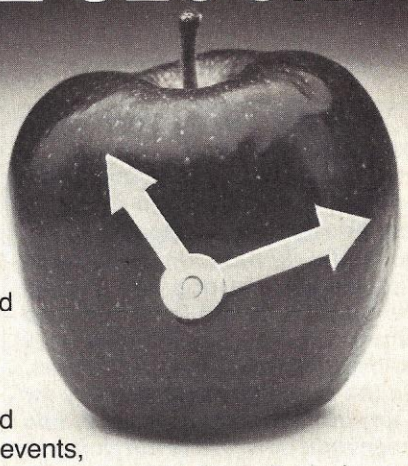

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Today We Control The House, Tomorrow...

Mark Garetz

*We've all heard stories about how the home computer can be used for turning the sprinklers on and off, controlling the lights in the house, the temperature and humidity, turning on the coffee pot, feeding the dog and putting the cat out. Some of those, and other, "exotic" applications may be best left to our grandchildren. On the other hand, we're ready for many of them right now. And, I do mean **right** now. We're not going to have to tear the walls out of our houses and install wiring to every room, either. This article examines the programming and interfacing of a home computer to a commercially available remote-control unit for turning on lights and appliances throughout the house. By themselves these units are impressive in their operation, but the addition of the computer opens up a wider range of capabilities and options...not the least of which is an excellent security system.*

System Components

The nucleus of the system is a series of products manufactured by BSR (the same folks that make the turntables) and marketed by Sears, Radio Shack and BSR themselves. Officially it's called the BSR System X10, but Sears calls it the Sears Home Control System and Radio Shack refers to it as Plug 'n Power.

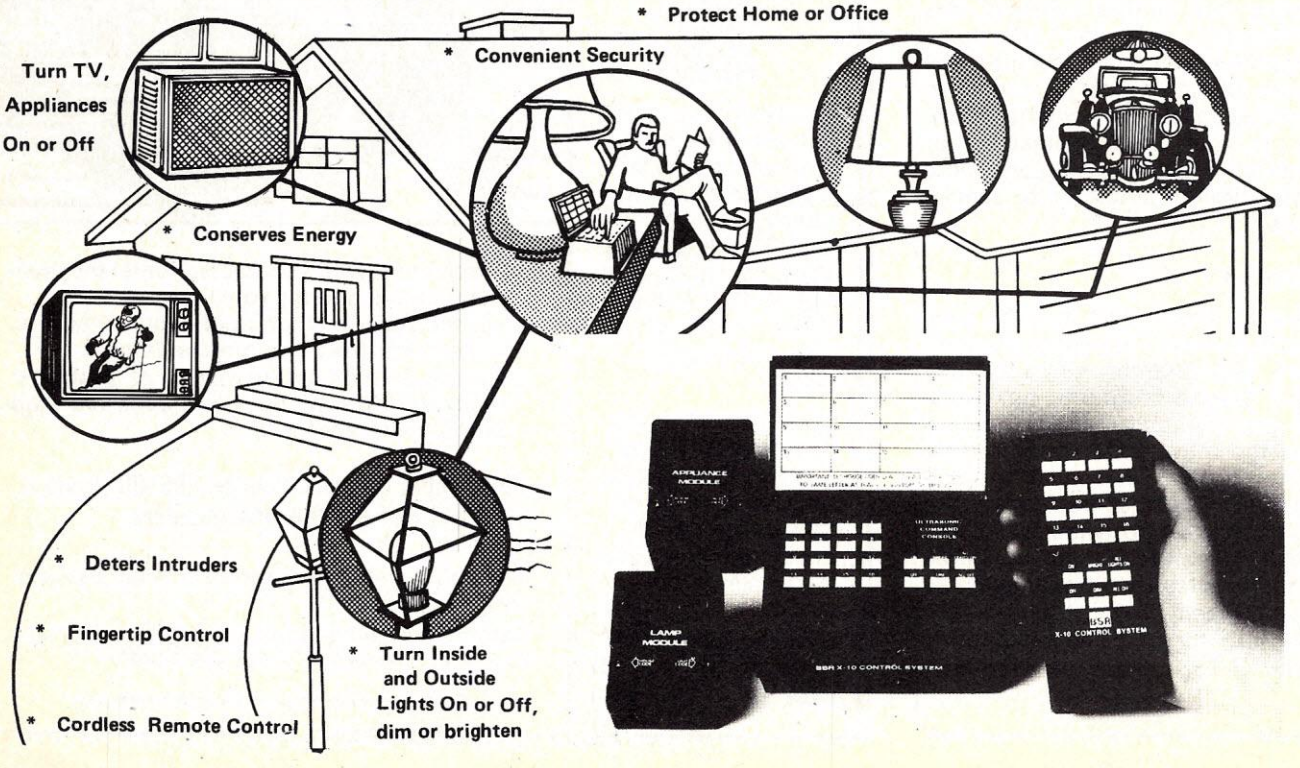
The product line consists of five separate items. The first is the Command Console (everyone's terminology is a bit different, but I have the Sears system and it's the most readily available and also the cheapest, so I will use the Sears terminology). The Command Console is a small box that plugs into any standard outlet and has a calculator style keyboard on it with 16 numbers and 6 command keys. It works in conjunction with the other four products; the Lamp Module, the Appliance Module, the Wall Switch Module and the Cordless Controller. Four of the units are shown in the photo.

In brief, the system works like this. You plug a lamp into the Lamp Module, plug the Lamp Module into the wall and then you can turn the lamp on and off with the Command Console. The Command Console sends FM digitally coded signals over the house wiring to the Lamp Module.

The numeric keys on the Command Console are numbered 1 thru 16. These keys tell the Command Console which device you want to control. Then there are 6 command keys that tell the Command Console what to do with the selected device. Also, there is a thumbwheel switch on the bottom called the House Code selector. It has the letters A through P on it, and is intended to keep a neighbor with a similar system from turning your lights on and off (the system works anywhere on the same power distribution transformer and there are usually several houses per transformer). Although that is the intended purpose of the switch, it can also be used to control up to 16 banks of 16 devices for a total of 256.

There are two different modules that plug into the wall which have things plugged into them. One is the Lamp Module and the other is the Appliance Module. They are both about the size of an AC adapter. The basic difference between the two modules is that the Lamp Module can be used only with incandescent lamps and the Appliance Module can be used with anything. The reason is that the Lamp Module outputs DC to the lamp, not AC, so it can also work as a lamp dimmer. The Appliance Module switches AC to heavier duty devices such as television sets and thus is not dimmable.

Mark Garetz, MICRONICS, 1429 Maple St., San Mateo, CA 94402.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* Turn Inside and Outside Lights On or Off, dim or brighten
APPLIANCE MODULE
LAMP MODULE
X-10 CONTROL SYSTEM

Tomorrow, con't...

There is also a wall switch module that looks like and replaces a standard wall switch. It is controlled by the switch on the unit or by the Command Console. It, like the Lamp Module, can only be used with incandescent lamps and is dimmable.

The last device in the family is the Cordless Controller. The Command Console has an ultrasonic receiver which receives signals from the Cordless Controller. The Controller has a keyboard identical to the one on the Command Console and by aiming it at the Command Console you can duplicate any of the functions of the console remotely. Its range is about thirty feet.

System Functions

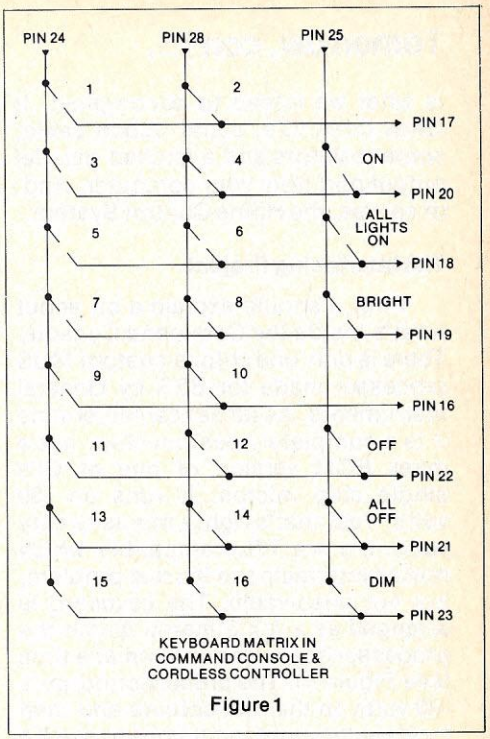
So much for the hardware involved. Now let's examine the system commands and functions. First of all, there are on and off functions. By pressing the desired device key and then the on/off key you can control the device's on or off state.

I mentioned before that the lamp and wall switch modules could control the lamp's brightness. There are two command keys for this function. They are "bright" and "dim." If a lamp is on and you want to dim it to a lower level the dim key is pressed until the lamp reaches the desired brightness. To reverse the process one simply presses the bright key.

Another command is "All Off." Pressing this key turns every module in the system off. Imagine you are lying in bed and are ready to turn in for the night. Of course, you have a command console at your bedside, so you hit the All Off key and all the lights and appliances in the house go off, even if you forgot to turn them off individually. Now suppose you're lying there in the dark and you hear a strange noise. This brings us to the last command key which is "All Lights On." Now when you hear this strange noise you simply hit the All Lights On key and all the lights in the house come on at once, which scares your cat to death (or the cat burglar). Notice that this key deals specifically with lights. Appliance modules will not respond to this command (it wouldn't do to have the blender, coffee pot and stereo come on to frighten the burglar).

This covers all the commands except for one important feature. Suppose you want to turn lights 1,3,7 and 16 on or off at the same time. Well you can just hit those number keys and then the command key and all those modules will respond at the same time. The Command Console will remember that you are working with that group (or single device for that matter) until you hit different number keys. In other words, once you have told it which device numbers you want to control you can hit any sequence of command keys without having to hit the number keys again. (Have you guessed that there is a microprocessor in the Command Console?)

I'm sure you can see by now that it's a pretty powerful system by itself. But what if we could get our computers to press the keys for us? That



KEYBOARD MATRIX IN COMMAND CONSOLE & CORDLESS CONTROLLER

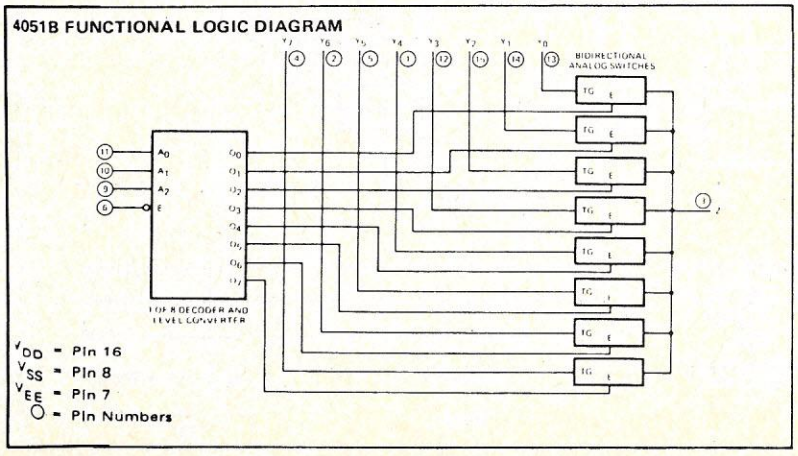
Figure 1

TRUTH TABLE

INPUTS				CHANNELS							
$\bar{E}$	A_2	A_1	A_0	Y_0–Z	Y_1–Z	Y_2–Z	Y_3–Z	Y_4–Z	Y_5–Z	Y_6–Z	Y_7–Z
L	L	L	L	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
L	L	L	H	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
L	L	H	L	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
L	L	H	H	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
L	H	L	L	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
L	H	L	H	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
L	H	H	L	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
L	H	H	H	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
H	X	X	X	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

L = LOW Level
H = HIGH Level
X = Don't Care

Figure 2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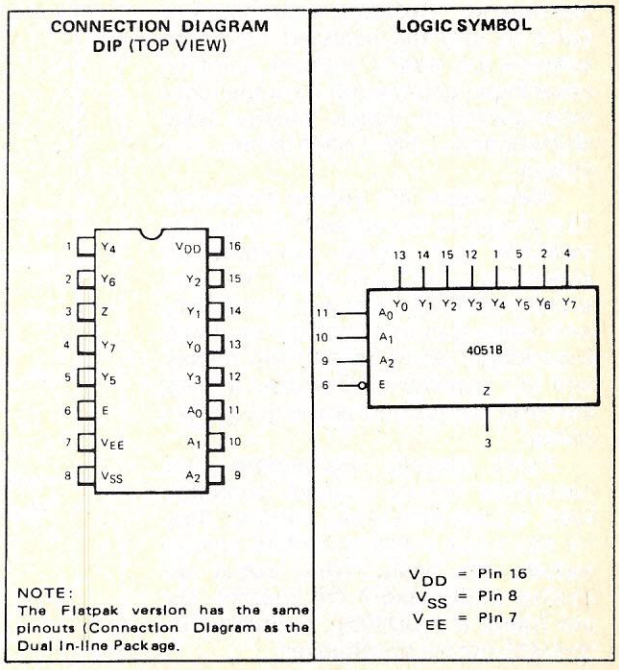

Tomorrow, con't...

is what we intend to accomplish. It takes three IC's, some ribbon cable, some resistors and a latched parallel output port from your computer. And, of course, the Home Control System.

The Interfacing Project

First, I should explain a bit about what's inside the Command Console. There is only one chip, a custom MOS processor made for BSR by General Instruments. As far as I can determine it is a completely custom chip, not a mask ROM version of one of GI's single chip micros. It runs on -20 volts. Yes, that's right - minus twenty volts. It's not TTL compatible which makes interfacing to it a real problem, but not unsolvable. The keyboard is arranged as a 3 x 8 matrix which the processor scans one column at a time (see Figure 1). The processor outputs -20 volts on the first column and then looks at the eight input lines to see if a key was pressed; the -20 volt signal gets connected to an input. If no key was pressed then the processor turns off the voltage to that output and turns on the second column and so on until you press a key.

Now our task is to simulate the key presses. A straightforward, but impractical, method would be to position a lot of solenoids over the keys and turn them on and off so that they actually pressed the keys. This will be discarded for obvious reasons.

Another interfacing problem is the 'hot' ground in the command console...whoops! (A hot ground is when the ground is connected to one side of the AC line.) Optoisolators come to mind, but twenty-two optoisolators is too messy. Besides, optoisolators don't fit into the scanned keyboard scheme too easily without a lot of other logic, and we still have the logic incompatibility which means level shifters and... like I said before, too messy.

Well, there are analog switches. That might be the answer. But analog switches that switch -20 volts are expensive, not too easy for the average hobbyist to come by and they only come four to a package so that's 6 packages which is still too messy and too expensive. Besides, there's still that hot ground problem to overcome.

Don't despair. Remember that hand-held remote control console? Well, it runs on a 9 volt battery. Now we can use a standard CMOS analog switch. No, wait. What about an analog multiplexer? Of course! My old friend the CD4051. A one-input-to-eight-output multiplexer.

The cat's out of the bag. It's done by using three CD4051's, one for each row. The multiplexer works by taking one input signal and switching it to one of the eight outputs. The desired output is selected by a three bit digital code on the select inputs, plus there is an inhibit line that turns off all the outputs. The select and inhibit inputs are TTL compatible (with pull-up resistors) and the analog signal path can handle 15V peak to peak. Now the -9 volts is no problem at all. A block diagram of the CD4051 is shown in Figure 2.

By electing to use the Cordless Controller to interface to the computer, instead of the Command Console, we have solved all our problems at once. Our logic compatibility problem is solved because the multiplexers can be controlled directly by any TTL signal. The complexity and other problems are solved because the interface requires only three IC's. And the hot ground problem is avoided because there is no connection between the Cordless Controller and the Command Console - they're sonically coupled (a new wrinkle in the isolation field).

The Nuts and Bolts

Let's get to the nitty gritty of how to construct this project. First, you need a Home Control System consisting of a Command Console, a Cordless Controller and any number of lamp or appliance modules. Be sure you get the type of command console that responds to the ultrasonic signals transmitted by the cordless controller. Radio Shack is not marketing the Cordless Controller so it is not clear if their version of the Command Console will respond to the ultrasonic signals or not.

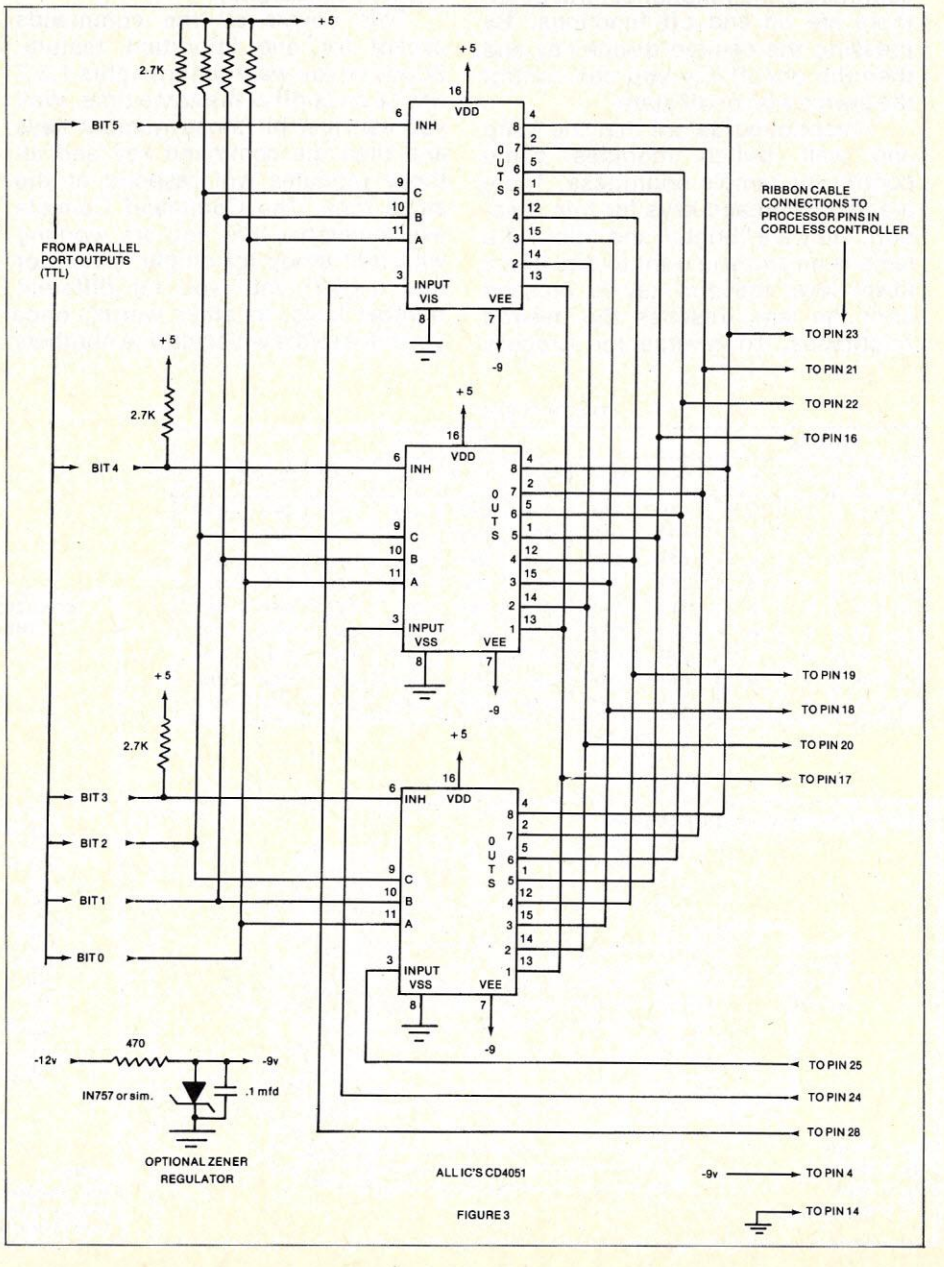

FIGURE 3

Tomorrow, con't...

You will also need a computer that has a latched parallel output port (TTL compatible). It should also have some way of providing regulated +5 volts and -9 to -12 volts. If you have an S-100 bus computer we will show you how to wire up a suitable port in the event you don't have a spare one. In a followup article we'll provide details for interfacing to some of the other popular home computers.

You'll need some kind of perf-board and the necessary sockets, wire and components. If you're building the S-100 version you should get an S-100 "prototyping board." I used the one from Artec Electronics and, though it's not the best, it's adequate. (It's inexpensive, anyway.)

You'll also need to decide what construction method you want to use. To be really elegant you might want to design and etch your own PC board. You might want to use point to point soldering; or, you might choose the method I used, which is wire-wrap. I used the Vector Slit'nWrap which is very convenient and a great time saver.

All of the components may be purchased at most hobbyist oriented electronics stores such as Radio Shack, Olson, Lafayette, or from any of the many mail order parts suppliers such as:

Godbout Electronics
Box 2355
Oakland Airport, CA 94614
(415) 562-0636

Jade Computer Products
4901 West Rosecrans
Hawthorne, CA 90250
(213) 679-3313

Jameco Electronics
1021 Howard Ave.
San Carlos, CA 94070
(415) 592-8097

Advanced Computer Products
P.O. Box 17329
Irvine, CA 92713
(714) 558-8813

Write or call for their catalogs and current prices.

The schematic for the interface is shown in Figure 3. Wire up the circuitry exactly as shown. The inputs and outputs to the cordless controller will be connected via a ribbon cable. The cable can be directly wired to the interface circuitry or you may want to use some sort of connector so it can be disconnected. The choice of connector system is up to you. I chose to use an IC socket and a DIP header on the S-100 board

The hardest part of the construction is wiring the ribbon cable up to the cordless controller, so I will try to detail it here as best I can. The cable length should be less than 36 inches.

Begin by removing the back of the cordless controller. You will notice that there is a circuit board with a 28 pin IC, a few discrete components and the ultrasonic transducer. Do not attempt to remove the circuit board as all the keys will fall out.

We are going to solder the ribbon cable directly to the pins of the IC. Begin by removing the battery (if there is one). Take your soldering iron (nothing above 40 watts!) and apply small dabs of solder to the following IC pin numbers: 4, 14, 16 through 26 and 28. Be careful not to create any solder "bridges" between the pins. Now take the ribbon cable and prepare the end by separating the wires from each other back about an inch. Strip about 1/8 of an inch of insulation off each wire. Twist the strands of each wire together and then apply solder to these ends. Don't apply big globs of solder, just enough to keep the strands together and to make soldering to the IC pins easier. Do this for each of the wires.

Now we are ready to attach the cable to the IC pins. Making sure that you have the right wire going to the right pin number as shown in the schematic (Figure 3), hold the wire against the pin of the IC and touch the soldering iron to the wire and pin together. Since there is solder on the pin and the wire, they should melt together and no further solder should

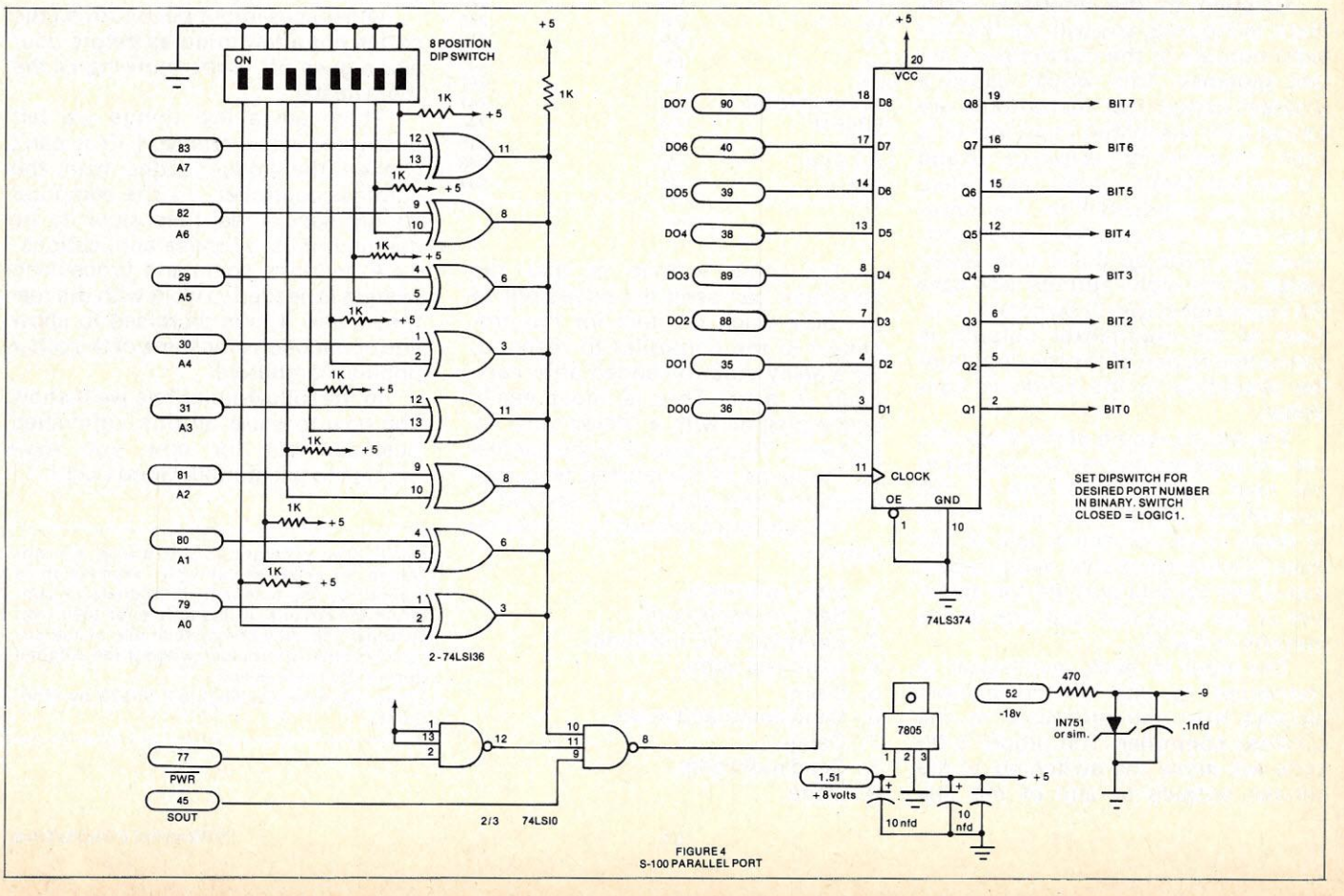

FIGURE 4
S-100 PARALLEL PORT

Tomorrow, con't...

be needed. This alleviates the need to grow a third arm and hand. As soon as you see the solder flow, remove the iron and hold the wire still until the solder cools. Take extreme caution not to create solder bridges between the IC pins. Repeat this procedure until all 13 wires have been attached. Double check all your connections for solder bridges, and to see that everything is wired according to the schematic.

Attach the interface to your parallel port by whatever method is convenient. Put a fresh 9 volt battery into the cordless controller (only the battery seems to be able to provide enough current for the transducer). Set the cordless controller down such that the command console can receive the signals. All that remains to do is turn on the computer and see if it works.

If your port has -12 available but not -9, you will need to build the optional zener regulator shown in the schematic. If you're building the S-100 version, this part of the schematic is duplicated in Figure 4. Don't build it twice.

Circuit Operation

At this point I'd better explain how the hardware works. This will help you understand the software requirements, which I'll get to later.

Refering to the interface schematic in Figure 3, you will see that the eight outputs of the multiplexers are tied together. This would cause a problem except that the outputs are turned off if the Inhibit input (pin 6) is high. The select inputs (pins 9, 10 and 11) are also tied together. The select inputs are connected to the lowe three bits of the parallel output port. Thus, the code on these bits select which of the eight outputs will have the input signal (pin 3) switched to it. Each of the multiplexer outputs is connected to one of the row inputs of the processor in the cordless controller.

The inhibit inputs of the three IC's are left separate and are connected to the next higher three bits of the parallel port. Thus, a low level on one of these lines will select one of the three IC's to be operable. With these 6 bits of the parallel port we can select one of the three IC's and one of the outputs of that IC.

The input to each multiplexer is connected to one of the column outputs from the processor in the cordless controller. The proper 6 bit code will allow the switching of the column outputs to any of the row inputs. This is exactly what happens when a key is pressed, which means we have successfully emulated the key presses with the computer.

The Software

Now, onto the software. Basically, all the software has to do is to output the appropriate 6 bit code to the parallel port to cause things to happen. There are a few minor wrinkles, however.

If you look at the table of codes (Table 1), you will see that there are 23 separate codes: 16 numeric codes, 6 command codes and 1 null code. The null code is very important. We must send this in between each command code. This simulates taking your finger off the key. It should also be sent after each sequence of codes to preserve the battery life in the cordless controller, as significant battery power is only drawn when keys are pressed.

Table of Command Codes

COMMAND	HEX CODE	DECIMAL CODE
NULL	FF	255
1	D8	216
2	E8	232
3	D9	217
4	E9	233
5	DA	218
6	EA	234
7	DB	219
8	EB	235
9	DC	220
10	EC	236
11	DD	221
12	ED	237
13	DE	222
14	EE	238
15	DF	223
16	EF	239
ON	F1	241
ALL LIGHTS ON	F2	242
BRIGHT	F3	243
OFF	F5	245
ALL OFF	F6	246
DIM	F7	247

Table 1.

The other wrinkle is that the computer can send the codes out to the port much too fast for the processor in the controller to respond. So a delay must be added after each code is sent. This is most easily accomplished with a "delay loop" in software. This is also why the parallel port must be of the latched type. The delay time should be ½ to 1 second.

The software sequence should go like this:

1. Send null code.
2. Send numeric code.
3. Delay for ½ to 1 second.
4. Send null code.
5. Delay.
6. Send command code.
7. Delay.
8. Send null code.
9. Done.

The easiest way to play with the system is to use Basic with an OUT or POKE command, or with a machine language monitor using OUT instructions. Start by using the direct execution mode of your Basic (that's when you type Basic command statements directly from the keyboard, not in program lines). The time it takes to type should be enough delay. Be sure to send the null codes or the next command will be ignored.

Writing a Basic subroutine to take a command value and output it with the necessary nulls and delay should not be difficult. A simple for-next loop should be adequate for delay purposes. The number of iterations (times through the loop) will depend on the speed of your Basic.

Summary

Well, there you have it. An interface to all your home lights and appliances. What can you do with that? I'm sure you've thought of several uses by now, but the best way I've found to come up with uses is to sit around with some friends and brainstorm. I though the perfect use would be for an intelligent security system. Not necessarily for alarms but to simulate people being in the house when you're away. With the computer in control you can make it look like someone is walking around the house by turning room lights on and off in a logical sequence, along with the TV, stereo and other devices.

Other uses might be to turn on the coffee pot a few minutes before your alarm goes off in the morning or the room heater.

There are a few things we left uncovered in this article: 1.) You can't change the house codes with the cordless controller. 2.) The computer should have a real-time clock to be useful in most of these applications. 3.) A software command processing system is needed to work with the real time clock. 4.) We promised to show you connections for some of the other popular computers.

In the follow-up article we'll show you how to solve all this unfinished business but for now you have enough to get started. Good Luck! □

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Computer Design Labs

Z80* Disk Software

We have acquired the rights to all TDL software (& hardware). TDL software has long had the reputation of being the best in the industry. Computer Design Labs will continue to maintain, evolve and add to this superior line of quality software.

— Carl Galletti and Roger Amidon, owners.

All of the software below is available on any of the following media for operation with a Z80 CPU using the CP/M* or similar type disk operating system (such as our own TPM*).

for TRS-80* CP/M (Model One)
for 8" CP/M (soft sectored single density)
for 5¼" CP/M (soft sectored single density)
for 5¼" North Star CP/M (single density)
for 5¼" North Star CP/M (double density)

BASIC I

A powerful and fast Z80 Basic interpreter with EDIT, RENUMBER, TRACE, PRINT USING, assembly language subroutine CALL, LOADGO for "chaining", COPY to move text, EXCHANGE, KILL, LINE INPUT, error intercept, sequential file handling in both ASCII and binary formats, and much, much more. It runs in a little over 12 K and is ROMable. An excellent choice for games since the precision was limited to 7 digits in order to make it one of the fastest around. $69.95.

BASIC II

Basic I but with 12 digit precision to make its power available to the business world with only a slight sacrifice in speed. Still runs faster than most other Basics (even those with much less precision). $99.95

BUSINESS BASIC

The most powerful Basic for business applications. It adds to Basic II with random or sequential disk files in either fixed or variable record lengths, simultaneous access to multiple disk files, PRIVACY command to prohibit user access to source code, global editing, added math functions, and disk file maintenance capability without leaving Basic (list, rename, or delete). $159.95.

ZEDIT

A character oriented text editor with 26 commands and "macro" capability for stringing multiple commands together. Included are bidirectional search with optional replace and a complete array of character move, add, delete, and display functions. $49.95.

ZTEL

Z80 Text Editing Language - Not just a text editor. Actually a language which allows you to edit text and also write, save, and recall programs which manipulate text. Commands include conditional branching, subroutine calls, iteration, block move, expression evaluation, and much more. Contains 36 value registers and 10 text registers. Be creative! Manipulate text with commands you write using Ztel. $68.95.

TOP

A Z80 Text Output Processor which will do text formatting for manuals, documents, and other word processing jobs. Works with any text editor. Does justification, page numbering and headings, spacing, centering, and much more! $68.95

*Z80 is a trademark of Zilog
*TRS-80 is a trademark of Radio Shack

MACRO I

A macro assembler which will generate relocateable or absolute code for the 8080 or Z80 using standard Intel mnemonics plus TDL/Z80 extensions. Functions include 14 conditionals, 16 listing controls, 54 pseudo-ops, 11 arithmetic/logical operations, local and global symbols, chaining files, linking capability with optional linker, and recursive / reiterative macros. This assembler is so powerful you'll think it is doing all the work for you. It actually makes assembly language programming much less of an effort and more creative. $49.95

MACRO II

Expands upon Macro I's linking capability (which is useful but somewhat limited) thereby being able to take full advantage of the optional Linker. Also a time and date function has been added and the listing capability improved. $68.95

LINKER

How many times have you written the same subroutine in each new program? Top notch professional programmers compile a library of these subroutines and use a Linker to tie them together at assembly time. Development time is thus drastically reduced and becomes comparable to writing in a high level language but with all the speed of assembly language. So, get the new CDL Linker and start writing programs in a fraction of the time it took before. Linker is compatible with Macro I & II as well as TDL/Xitan assemblers version 2.0 or later. $68.95

DEBUG I

Many programmers give up on writing in assembly language even though they know their programs would be faster and more powerful. To them assembly language seems difficult to understand and follow, as well as being a nightmare to debug. Well, not with proper tools like Debug I. With Debug I you can easily follow the flow of any Z80 or 8080 program. Trace the program one step at a time or 10 steps or whatever you like. At each step you will be able to see the instruction executed and what it did. If desired, modifications can then be made before continuing. It's all under your control. You can even skip displaying a subroutine call and up to seven breakpoints can be set during execution. Use of Debug I can pay for itself many times over by saving you valuable debugging time. $69.95.

DEBUG II

This is an expanded debugger which has all of the features of Debug I plus many more. You can "trap" (i.e. trace a program until a set of register, flag, and/or memory conditions occur). Also, instructions may be entered and executed immediately. This makes it easy to learn new instructions by examining registers/memory before and after. And a RADIX function allows changing between ASCII, binary, decimal, hex, octal, signed decimal, or split octal. All these features and more add up to give you a very powerful development tool. Both Debug I and II must run on a Z80 but will debug both Z80 and 8080 code. $88.95.

TPM is a trademark of Computer Design Labs. It is not CP/M
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ZAPPLE

A Z80 executive and debug monitor. Capable of search, ASCII put and display. read and write to I/O ports, hex math, breakpoint, execute, move, fill, display, read and write in Intel or vinary format tape, and more! Disk $19.95. Also available in 2Kx8 ROM with initialization for the SMB I or II (3 ACIA's and 1 PIA) $34.95.

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A NEW Z80 disk operation system! This is not CP/M*. It's better! You can still run any program which runs with CP/M* but unlike CP/M* this operating system was written specifically for the Z80* and takes full advantage of its extra powerful instruction set. In other words its not warmed over 8080 code! Available for TRS-80*, Tarbell, ICOM, Xitan DDDC, SD Sales "VERSA-FLOPPY", North Star (SD&DD), and Digital (Micro) Systems. $49.95.

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The Osborne package. Requires C Basic 2
2 disks $74.95 Book $15.00

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Book $15.00.

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C BASIC 2

Required for Osborene software $99.95
Manual included.

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Visa, Master Charge and C.O.D. O.K. To order call or write with the following information.

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2. Media (e.g. 8" CP/M)
3. Price and method of payment (e.g. C.O.D.) include credit card info. if applicable.
4. Name, Address and Phone number.
5. For TPM orders only: Indicate if for TRS 80, Tarbell, Xitan DDDC, SD Sales (5¼" or 8"), ICOM (5¼" or 8"), North Star (single or double density)or Digital (Micro) Systems.
6. N.J. residents add 5% sales tax.

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Trenton, N.J. 08629
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For tech calls: United Software Applications 609-599-2146 or Otto Electronics 609-448-9165

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Computer Aided Manufacturing

Part II: Data Base & Reporting Activities

Chuck Carpenter

In Part I we discussed the Manufacturing Operations environment and concluded with a promise to continue with development of Data Base Contributors (and several related topics). Let's start there and follow CAM to it's conclusion.

Contributors To The Data Base

Manufacturing Bill of Materials - This is the key, most significant element for establishing the product assembly environment. The bill of material represents the engineering drawings for the product. Bills of material (or Parts Lists) become the basis for:

- Inventory Control, purchasing and stores
- Assembly Instructions
- Work stations
- Labor standards
- Product Cost
- Manpower Planning
- Packaging
- Quality, Receiving and In-process

Developing a computer controlled manufacturing operations system will start with the bill of material. Everything that happens to the parts, once they are in your plant, will become value added to the product. The overheads for storage, the handling and assembly efficiency, loss and attrition of material all contribute to the cost of the product. Or, even more significantly, the final profit is affected by how efficient the flow of material is handled. Lack of efficiency shows up as off-standard cost and an increase in the operating overhead cost. Listing 1 illustrates a manufacturing bill of material and includes significant information for data base development. (Figure 1 represents a part numbering technique. This technique reduces the amount of information needed to describe and define an item.)

Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.

```
**** MANUFACTURING BILL OF MATERIAL ****

PART #   DESCRIPTION #/A USED ON# LBR/STD COST

12A687A FRIZNARIS   1   10A234B  4.1     14.86
31P842C WIDGET      1   12A687A  0       3.17
81P123D SNURFER     1   12A687A  0       2.68
15P987F HOOKER      5   12A687A  0       .05
61P543A BUZZER      1   12A687A  0       1.18
13P501B HANGER      2   12A678A  0       .15
21P109E BINDER      5   12A678A  0       .15
77P234A JAMMER      1   12A678A  0       1.76
34P140B HUMMER      1   12A678A  0       1.13
95P673A WOBBLER     1   12A678A  0       2.09
15P332C DUNKER      1   12A678A  0       1.36
```

Listing 1 A Manufacturing Bill of Material.

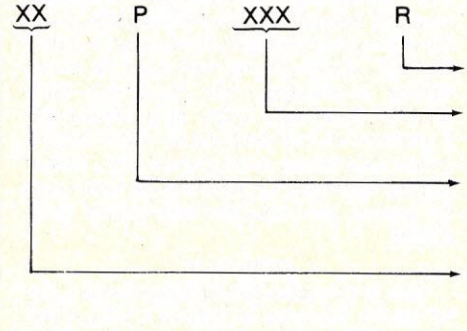
Assembly Instructions - This is the most significant document to be developed from the bill of material. The Assembly Instruction (AI) is an interpretation of engineering documentation and represents the methods used to build the product. The intent of the design criteria is accomplished through the techniques implemented by the AI. The following information should be contained in the AI:

- List of Material used
- Elements of assembly instructions
- Assembly tools used
- Work station configuration
- Special methods information
- Standard Assembly Time

Configuration and cost data bases are developed from the AI. The material needed to build a production

PART NUMBERING TECHNIQUE

Part Number Significance



If more categories or sequential numbers are needed, increase the number of digits in that field.

This system reduces the amount of information needed to describe and define a part. Less Computer Memory and fewer report lines are used. Visual part identification and correlation is also easier.

Figure 1 Part Number Technique.

CAM, con't...

lot can be determined from the AI. Production control scheduling and work-in-process inventory are controlled through the AI, and the amount of space needed and the time it takes to do the job can be determined from the AI. A typical assembly instruction is shown in listing 2a and 2b. The assembly instruction draws heavily on the data base information: bills of material, labor standards, and product cost being significant contributors. As much detail as is required to meet the intent of your engineering design and establish the manufacturing cost should be included as part of your total AI package.

Work Station Development - Total facility requirements needed to efficiently build, test, package and transport the product during the manufacturing cycle are developed from individual work station design. By assembling each work station into an integrated production line, you can develop a product flow concept. The flow you design should include enough detail to minimize the areas where excessive costs would occur. If your product is material intensive, then consideration of material waste may be your major goal. If the goal you are after is labor intensive, then look for methods to reduce the time it takes to do the task.

Labor Standards - Why does a small company need labor standards? The more accurately you want to know the cost of building your product, the more accurately you need to measure the labor content of the product. Additionally, overhead analysis and profitability need to be calculated and measured from an accurate direct labor base. Estimating costs for a bid package will be more accurate and with less error margin if labor is measured and not guessed at. This holds true whether you're running a job shop or a high volume production line.

Everything that happens to the parts, once they are in your plant, will become value added to the product.

Incentive, non-incentive and measured day work are assembly environments where labor standards can be used. Work measurement includes stop watch techniques, pre-determined labor standards and standard data. Stop watch techniques require more manpower to administer and are highly subjective in the area of leveling and effort determination. Predetermined standards range from complex for detailed assembly to simple for tasks that are less labor intensive. Predetermined standards can be established in advance of actual assembly and need only to have a detailed process and method to insure accuracy. Factors related to the personality of your operating environment can be included to adjust the final labor cost. Some of these factors are:

Personal, Fatigue and Delay allowances (PF&D) — Includes breaks, personal hygiene, start up and clean up and slowing of pace due to tiring

Absenteeism

Utilization

Balancing delay (progressive line)

Material Shortages

Structural Complexity

```
        **** ASSEMBLY INSTRUCTION ****

PART #: 12A687ADESC:FRIZNARIS      DATE:05/05/79
USED ON #: 10A234B

ELELOC QTY PART #    METHOD                  TOOL #

10                   GET FROM PART LOCATIONS
  A    1   31P842C
  B    1   81P123D
  D    1   61P543A
                     USING TOOLS             1H3562
                                             2D3487
                                             681652
                     ASSEMBLE TOGETHER WITH
                     PARTS FROM LOCATIONS
  C    2   15P987F
  F    2   21P109E  & TORQUE TO 8 IN.LBS.

LABOR STANDARD: 0


        **** ASSEMBLY INSTRUCTION ****

PART #: 12A687ADESC:FRIZNARIS .    DATE:05/05/79
USED ON #: 10A234B

ELELOC QTY PART #    METHOD                  TOOL #

20                   GET FROM PARTS LOCATIONS
  E    2   13P501D
  G    1   77P234A
  H    1   34P140B
  I    1   95P673A
                     USING TOOLS FROM ELE. 10
                     ASSEMBLE TOGETHER WITH
                     PARTS FROM LOCATIONS
  C    3   15P987F
  F    3   21P109E  & TORQUE TO 8 IN.LBS.

LABOR STANDARD: 0
```

Listing 2A Assembly Process Example.

```
        **** ASSEMBLY INSTRUCTION ****

PART #: 12A687ADESC:FRIZNARIS      DATE:05/05/79
USED ON #: 10A234B

ELELOC QTY PART #    METHOD                  TOOL #

25                   VERIFY ALL DIMENSIONS
                     USING GUAGE             9I2107

                     VERIFY ALL TORQUES
                     USING GUAGE             9I1738

                     NO INTERACTIONS ON
                     THIS ASSEMBLY

LABOR STANDARD: 0
```

Listing 2B Inspection Process Example.

CAM, con't...

Once these factors are accounted for, a true value of labor cost can be established. Any technique of labor measurement; stop watch, empirical or predetermined will yield the desired end result. The degree of accuracy needed will influence your choice.

The intent of the design criteria is accomplished through the techniques implemented by the AI.

Figure 2 illustrates a labor standard developed from predetermined time standards. Once the standard data is developed, it is an easy step to computerize the generation of labor standards and costs based on work content description.

Product Cost Estimate - At this point, with the various costs established, the cost of your product can be estimated. Accuracy of your estimate will depend on how many of the values are educated guesses. With actual values such as data from purchase orders, accurate quotes from suppliers and measured values for material and labor overhead, the estimate will be quite accurate. Improvement of accuracy will occur as your product ages toward end-of-life. Data developed to estimate product costs can become part of your data base for future cost development tasks. Adding factors to historical data to account for economic and other changes (inflation, etc.) will keep your data valid. A computerized summary is easily generated from the system data base.

Manpower Planning - Direct labor, your main manpower requirement, can be determined from the labor standards. With all the factors included that affect your absolute efficiency, the number of people needed is the hours it takes to do the job divided by the hours available in a work period (shift, day, etc.). Listing 3a is a sample RUN and 3b is a utility program to calculate direct manpower. Indirect manpower, such as material handlers, inspectors or any others that don't directly add value to your product are harder to establish. Your best estimate is needed here. Indirect work measurement studies can be implemented later. But these more sophisticated methods take manpower to support. Outside help is a viable alternative and you may choose to get temporary help from a consulting organization. Be sure to find one that can realistically relate to your situation. Again, the consultant fee, similar to hiring a programmer, is typically $20 to $35 an hour.

```
**** MANPOWER PROGRAM ****
INPUT VARIABLES TO BE USED FOR
MANPOWER CALCULATIONS

MONTH/YR.05/05/79

NO. OF MACHINES 100
LABOR STD-HRS/UNIT 3.5
HEDGE PERCENT 1.05
ATT. UTIL. EFF.-FACTOR .75
WORK DAYS/MONTH 21

CALCULATIONS:

EQUIVALENT HOURS = 490

AVAILABLE HOURS = 168

EQUIVALENT DIRECTS = 2.92

FACTOR INDIRECTS BY DIRECTS
AS A PERCENTAGE

ANY MORE CALCULATIONS Y/N N
```

Listing 3A Direct Manpower Calculation.

Packaging and Shipping - Here's another area where outside help may be your best choice. If your product can be damaged in shipment to the point of sale, then adequate packaging is a must. All your effort to produce a saleable item, that you expect profit from, is lost if you can't sell it. Your potential customers aren't interested in buying obviously damaged material or finding latent damage in the product when put to use. Anything you ship, regardless of how pretty you want the package, should meet the requirements of the National Safe Transit and Handling Standards. These standards, if met, will insure safe arrival of your product a high percentage of the time. Preventing the loss of goodwill is more effective than trying to overcome it after the fact.

Progress and Efficiency - Now that you have established how the product will be manufactured it's time to measure how well you're doing it. If you have established the profit you want to make and the cash flow that profit will generate, then measuring your progress on a real time basis is necessary. To protect your profit position, waiting for a periodic financial report may be too little too late. Use of progress curves and progress curve measurement techniques is a practical approach. Progress curves are used extensively by several national and multinational firms (IBM, Texas Instruments, etc.). However, the techniques are simple enough and use in a small company is very practical. The benefits derived are well worth the effort to implement

PROCESS ANALYSIS CHART	Assy No. XX A XXX A	Desc. Conduit Coupling	Page 1 of 1 Pages
	Op No. 10	Special Items None	Analyst Carpenter

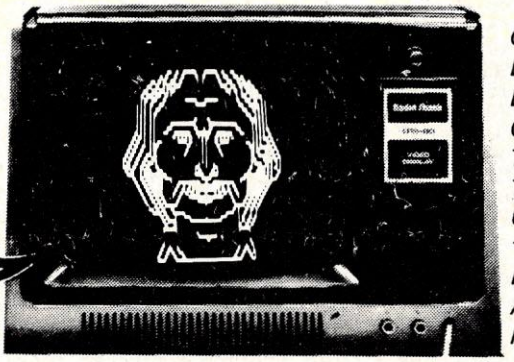
Line	Part No.	Assembly Step	No.	Code	Time
1	XX P XXX A	Get Threaded Body with R.H.		Ha 32	34
2		Position in L.H. Large End Out		TA 6	7
3		Regrasp in Hand to Reposition.		TA 6	7
4	XX P XXX A	Get Insert to Body Round End 1st.		HB 32	48
5		Push in Place		TA 6	7
6	XX P XXX A	Get Large Bushing		HB 32	48
7		Start on Threads.		TA 6	7
8		Run Down One Full Thread.	2	HA 6	36
9		Tighten Finger Tight		TA 6	7
10		Turn Part in Hand to Small End Out.	2	TA 6	14
11	XX P XXX A	Get Pipe Nut		HB 32	48
12		Start on Threads		TA 6	7
13		Run Down 5 Full Threads	10	HA 6	180
14		Tighten Finger Tight		TA 6	7
15		Aside to Bin		TA 32	16

	$\frac{473 + \%PF\&D}{x\ 10\text{-}3}$ = HRS/C	$\frac{473 + \%PF\&D}{1666.67}$ = MIN/PIECE	Total Time = 473

Figure 2 Labor Standard Using Predetermined Time.

TRS-80 owners LOOK

at these Programs!!! (and these prices!!)



Graphic Drawing Done On The TRS80 Using "The Electric Artist" Program!

GRAPHIC-TREK "2000" This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprize to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players!

INVASION WORG Time: 2099 Place: Earth's Solar System Mission: As general of earths forces, your job is to stop the Worg invasion and destroy their outposts on mars, venus, saturn, neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Nuetrino Blasters! Worg Forces: Robots — Saucers — Disintegraters — Proton Destroyers! Multi level game lets you advance to more complicated game as you get better!

STAR WARS Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb then escape via the only escape route. This graphics game is really fun! May the force be with you!

SPACE TARGET Shoot at enemy ships with your lazer gun. If they eject in a lifeboat vehicle, capture them, or if your cruel, destroy them! Full graphics, real time game!

SAUCERS This fast action graphics game, has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out! The saucers fight back!

Package One — $12.95

CHECKERS 2.1 Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. Computer also makes sly remarks about the game!

POKER FACE The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match!

PSYCHIC Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for party's.

TANGLE MANIA Try and force your opponent into an immobile position. But watch out, their doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!)

WORD SCRAMBLE This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles word then keeps track of wrong guesses. Can you make less mistakes then your adversary?

Package Two — $12.95

POETRY This exciting and sometimes funny program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then mood, and he does the rest! TRS-80 will write different poetry about one subject forever if you let him. Has a 1000 word + vocabulary of nouns, verbs, adjectives, adverbs!

ELECTRIC ARTIST Written by a working artist and a computer engineer to make drawing on the video screen easier then picking up a pencil! (Less messy too!) Manual: Draw, erase, move as well as, Auto: Draw, erase, move. Uses graphics bit's not bytes. Graphic face in ad done using this ingenius program!

GALACTIC BATTLE The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time!

WORD MANIA Can you guess the computers words using your human intuitive and logical abilities? You'll need to, to beat the computer! He keeps score and gets mad if he loses!

AIR COMMAND Real time, graphics Flight Simulater! Land, take-off, get out of a spin! Be careful not to stall! Watch your fuel gauge! Requires a clear headed pilot.

Package Three — $12.95

LIFE This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, computer does the rest! Program can be stopped and changes made! Watch it grow!

REAL TIME LANDER This full graphics simulater lets you pick what planet, asteroid or moon you wish to land on! The "Live" keyboard gives super response that gives you the feeling of being in command! Has 3 skill levels that make it fun for everyone.

GREED II Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy!

THE PHARAOH Rule the ancient city of Alexandra! Buy or sell land. Keep your people from revolting! Stop the rampaging rats and locusts'. Requires a true political personality to become good!

ROBOT HUNTER A group of renegade robots have escaped and are spotted in an old ghosttown on mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

Package Four — $12.95

SUPER HORSERACE! Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 9 people can play! Use's real odds but has that element of chance you see in real life! Keeps track of everyone's winnings and losings. This is one of the few computer simulations that can actually get a room of people cheering!

MAZE MOUSE The mouse with a mind! Computer generates random mazes of whatever size you specify then searches for way out! The second time thru he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouse!

AMOEBA KILLER You command a one man submarine that has been shrunken to the size of bacteria in this exciting graphic adventure! Injected into the presidents bloodstream, your mission is to destroy the deadly amoeba infection rampaging his body!

LOGIC This popular game is based on mastermind but utilizes tactics that make it more exciting and challenging! Has 2 levels of play to make it fun for everyone.

SUBMARINER Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

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CIRCLE 200 ON READER SERVICE CARD

CAM, con't...

```
7000  HOME : PRINT : PRINT : PRINT : PRINT  TAB( 1
0)"**** MANPOWER PROGAM ****"
7010  PRINT : PRINT : PRINT "INPUT VARIABLES TO BE
 USED FOR": PRINT "MANPOWER CALCULATIONS"
7015  PRINT : PRINT : INPUT "MONTH/YR.";M1$
7020  PRINT : INPUT "NO. OF MACHINES ";M1
7030  INPUT "LABOR STD-HRS/UNIT ";L1
7040  INPUT "HEDGE PERCENT ";S1
7050  INPUT "ATT. UTIL. EFF.-FACTOR ";F1
7060  INPUT "WORK DAYS/MONTH ";D1
7070  PRINT : PRINT "CALCULATIONS:":EH = (M1 * L1
* S1) / F1:AH = D1 * 8:DH =  INT ((EH / AH) * 100
+ .5) / 100
7080  PRINT : PRINT "EQUIVALENT HOURS = "; INT (EH
 * 100 + .5) / 100
7090  PRINT : PRINT "AVAILABLE HOURS = ";AH
7100  PRINT : PRINT "EQUIVALENT DIRECTS = ";DH
7110  PRINT : PRINT "FACTOR INDIRECTS BY DIRECTS":
 PRINT "AS A PERCENTAGE"
7120  PRINT : INPUT "ANY MORE CALCULATIONS Y/N ";M
C$: IF  MC$ = "Y"  THEN  7015
7130  GOTO  3000
```

Listing 3B Program Segment for Calculating Manpower.

and maintain a progress curve system. Computer aided systems makes this task even more practical.

But, what is a progress curve? Listing 4 (a, b and c) illustrates a typical curve (simplified) as it appears on log paper. The slope of the curve represents the improvement rate or progress of your manufacturing system. The curve starts with the time needed to build the first unit and ends with the last unit; the end of life for the product. Standard cost of the product is the horizontal line. This represents the estimated or predetermined labor cost of the product. The area of the curve prior to the standard cost point is learning cost. The area of the curve after the standard cost point is payback resulting from increased efficiency. (Efficiency is determined from the ratio of planned versus actual manufacturing costs.) The slope of the curve changes with the effort expended to support manufacture of the product and the slope will be different for the type of product being manufactured. The amount and skill of labor needed to build the product influences the rate of progress. Light electronics assembly typically progresses on an 80% slope. This improvement is somewhat misleading. The progress is actually a 20% reduction in assembly time each time the quantity of product (produced continuously) doubles. I included 'produced continuously' because products produced other than continuously affect the learning rate and increase the standard cost.

I've covered the subject rather briefly and this area deserves a more thorough treatment. The subject of progress curves is fascinating and provides an effective way of predicting and measuring manufacturing productivity. Here are a few of the things you can do with progress curve techniques:

Once the standard data is developed, it is an easy step to computerize the generation of labor standards and costs based on work content description.

Predict: Direct Labor Hours
- Learning Cost
- Rework Cost
- Downtime
- Material Cost

Establish Actual Progress

Indicate Efficiency

Determine: Product Cost
- Profit
- Line Balance
- Manpower
- Management Support
- Product Life

There are a number of calculations possible that determine characteristics of these curves. Simply drawing a curve on log-log graph paper and making predictions on several alternatives is possible, too. Such calculations can also be included as part of a computer program. In this case, your predictions on several alternatives are made quickly and automatically. Actual data, developed over product life, can be input and adjustments made to the support of the product as determined by the results. Profit goals are thus kept in line on a real time basis.

```
        **** PROGRESS CURVE PROGRAM ****

PRINT AN ILLUSTRATION - Y/N Y

        PROGRESS CURVE ILLUSTRATION

   !                                POINT (X) CAN
   !                                BE ANY PLACE
H  !                                ON THE SLOPE
  * <--K
O  !   +    POINT #1
   !       X
U  !            +
   !                + <-- SLOPE
R  !                    +
   !  (LEARNING)              +    POINT #2
S  !                           X
   !                                  +
   !-----------------------------------*---------
   ! STANDARD HOURS ↑                  !   +
   !                                   !       +
   !                          STANDARD !
   !                          COST---->!
   !                                   !
   !                                   !
   !---------!---------!---------!---------!-----
   1         10        100       1K        10K

                  CUMULATIVE UNITS

 (ACTUAL CHART WILL BE ON LOG/LOG GRAPH PAPER)


 CALCULATIONS MADE BY
 THIS PROGRAM

   1. TOTAL HOURS FOR UNIT #1
   2. TOTAL HOURS AT UNIT (X)
   3. PROGRESS SLOPE (%)
   0. ENDS THE PROGRAM

 WHICH ONE
 OR ALL - ALL
```

Listing 4A Example of a Progress Curve.

More Data Base Users

Quality Plan - In most small businesses a quality plan is often minimal to non-existent. If your business is with the government, then a quality plan is a requirement (with few exceptions). Again, to prevent loss of goodwill and customer acceptance of

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We offer you more and better choices. Sunshine Computer Company sells the best selection of small computers available including DEC's 11/03 and 11/23, Cromemco's Z2-H and System Three, the new TI 99/4, plus the best of Apple North Star, and Vector Graphic. From personal systems with floppy disks to full-fledged business systems with as much as 60 megabytes of on-line storage. We can help you find the right software, too. We feature powerful, field-proven packages for general business applications by companies like Structured Systems Group, Serendipity Systems, and Professional Systems Development, Inc. We also offer packages for specialized applications like property management, word processing, and data base management.

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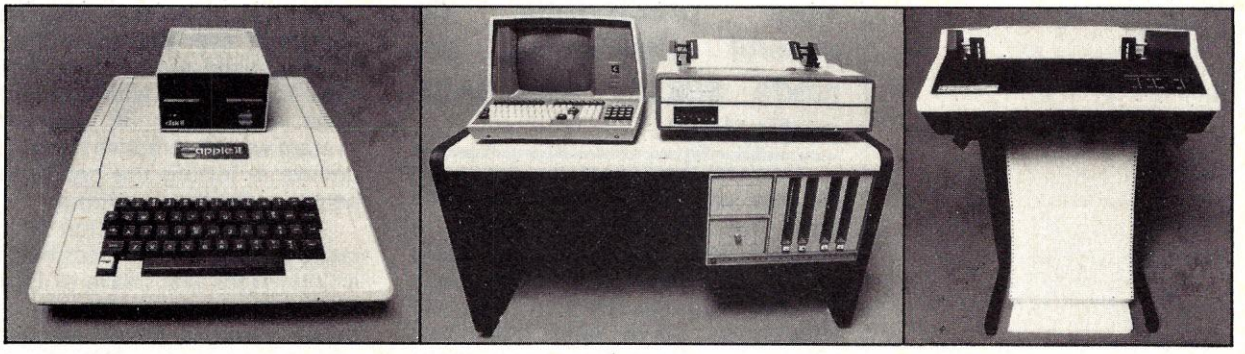

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The Sensible Alternative.

CAM, con't...

your product, a quality plan is desirable. Three major areas of your production cycle should be considered:

Incoming material quality
Inprocess assembly
Outgoing product quality

The Quality Control Handbook by Juran contains a wealth of information. The material covers many sizes and types of manufacturing environments. Any quality environment must be designed with your profit in mind. Quality can be controlled and made to pay for itself. It's very easy for rejectionitis to creep into a quality organization. Organizing your quality plan with an ACCEPTANCE philosophy keeps the attitude positive. You want to ship everything you should but keep below-standard items from getting into the market.

Report and Controls - Your job as a manager has only started with the development of a manufacturing plan. The tasks of measuring, interpreting, reporting and implementing any required corrective action will now become the major activities. Timely input and reaction capability will be necessary if you want to avoid panic responses to real problems. This is the most likely area for computer aided reporting. With all your data in a computer data base it becomes a simple matter to report the status of any (or all) of the various parts of your manufacturing plan. By designing the system to generate output on an exception basis the paper flow can be kept to a minimum too.

```
PRINT A LIST OF VARIABLES - Y/NY

VARIABLES USED BY
THIS PROGRAM

  THOSE CALCULATED

    PS = PROGRESS SLOPE AS A %
    HR = TOTAL HOURS AT UNIT (X)
    K = TOTAL HOURS AT UNIT #1

  THOSE REQUIRING INPUT

    X = CUM UNITS-AT POINT (X)
    X1 = CUM UNITS AT POINT #1
    X2 = CUM UNITS AT POINT #2
    Y = HRS/UNIT A STD COST
    Y1 = HOURS/UNIT AT POINT #1
    Y2 = HOURS/UNIT AT POINT #2
    N = EXPONENT (LOG S/LOG 2)
    S = PROGRESS SLOPE AS A DECIMAL
    S1 = INT. CALC OF 'PS'

NOTE:    CUM UNITS & LINE BAL UNITS
         CAN BE THE SAME DEPENDING
         ON THE CALCULATION.
         I.E. PAYBACK CALCULATIONS


 INPUT VARIABLES TO BE USED FOR
PROGRESS CURVE CALCULATIONS

CUM UNITS AT POINT (X) = 1212
HRS/UNIT AT STD COST = 3.5
SLOPE AS A DECIMAL = .8
CUM UNITS AT POINT #1 = 50
CUM UNITS AT POINT #2 = 900
HRS/UNIT AT POINT #1 = 25
HRS/UNIT AT POINT #2 = 6


CALCULATIONS:



1. TOTAL HOURS AT UNIT #1 = 34.41

2. TOTAL HOURS AT UNIT 1212 = 6225.29

3. PROGRESS SLOPE AS A % = 71.02



  0. ENDS THE PROGRAM

WHICH ONE
OR ALL - 0
```

Listing 4B Sample Progress Curve Calculation.

```
2130  HOME : PRINT : PRINT : PRINT : PRINT "INPUT
VARIABLES TO BE USED FOR": PRINT "PROGRESS CURVE C
ALCULATIONS"
2140  PRINT : INPUT "CUM UNITS AT POINT (X) = ";X
2150  INPUT "HRS/UNIT AT STD COST = ";Y
2160  INPUT "SLOPE AS A DECIMAL = ";S
2170  INPUT "CUM UNITS AT POINT #1 = ";X1
2180  INPUT "CUM UNITS AT POINT #2 = ";X2
2190  INPUT "HRS/UNIT AT POINT #1 = ";Y1
2195  INPUT "HRS/UNIT AT POINT #2 = ";Y2
2200  PRINT : PRINT : PRINT "CALCULATIONS:": PRINT
 : PRINT
2210  IF  PC$ = "ALL"  OR  PC$ = "1"  THEN  2300
2240  IF  PC$ = "2"  THEN  2400
2250  IF  PC$ = "3"  THEN  2500
2300 K = Y / X ↑ ( LOG (S) /  LOG (2))
2305 K =  INT (K * 100 + .5) / 100
2310  PRINT : PRINT "1. TOTAL HOURS AT UNIT #1 = "
;K
2315  IF  PC$ <  > "ALL"  THEN  PRINT : PRINT
2320  IF  PC$ <  >  "ALL"  GOTO  2040
2400 N =  LOG (S) /  LOG (2)
2410 HR = (((X + .5) ↑ (N + 1)) - ((.5) ↑ (N + 1))
) * ((K) / (N + 1))
2415 HR =  INT (HR * 100 + .5) / 100
2420  PRINT : PRINT "2. TOTAL HOURS AT UNIT ";X;"
= ";HR
2425  IF  PC$ <  > "ALL"  THEN  PRINT : PRINT
2430  IF  PC$ <  >  "ALL"  GOTO  2040
2500 S1 = ((( LOG (Y1)) - ( LOG (Y2))) / (( LOG (X
1)) - ( LOG (X2)))) * ( LOG (2))
2510 PS = (2.718283 ↑ S1) * 100
2515 PS =  INT (PS * 100 + .5) / 100
2520  PRINT : PRINT "3. PROGRESS SLOPE AS A % = ";
PS
2525  IF  PC$ <  > "ALL"  THEN  PRINT : PRINT
2530  IF  PC$ <  >  "ALL"  GOTO  2040
2540  PRINT : PRINT : PRINT : GOTO  2040
```

Listing 4C Program Segment for Calculating Progress Curves.

Your predictions on several alternatives are made quickly and automatically.

Don't let the generation of reports become an activity trap. Generate only the information needed to support your decisions and avoid letting the computer make decisions for you. Computers can compare alternatives on a cold calculated basis. But computers can't make judgments. Refer back to the rules of thumb by Robert Townsend. This insight into the potential of strangulation by computer output is significant. Let your computer (or automated) system work for you.

What Did He Say ?

A lot of information has been covered in this article. Some of it in detail. Some of it glossed over possibly a little too much. All of the information needs more detail, especially the section on progress curves and manufacturing efficiency. This section would be well placed at the beginning of an extended treatment of computer aided manufacturing. Progress curves are not really complicated and the benefits derived from their use in planning and measuring are invaluable.

Specific points have been made, here and there, that I think computer aided manufacturing is a desirable direction to go. I have also tried to make the point that you need to beware of over-extending the use of computerized automation. It's quite easy to wind up with computerized trivia. Especially if your manual system wasn't effective to start with. I believe in letting the computer only help to make the decisions.

Computer automation of all the tasks and activities described in this article is feasible. I have written some of the programs I think are needed. Utility versions have been included with this article as examples. A complete small business CAM system is the intended end result. Detailed expansion of each section will include these programs as part of future articles on Computer Aided Manufacturing. □

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Most people say, "more memory, more speed, more disk capacity, higher resolution and better software." We disagree. In fact, we don't really think you should buy a computer system any differently than you buy a TV set.

When you buy a TV set you're really buying family entertainment — golf matches and football games, soap operas and movies, news and drama, Mork and Mindy. Aren't you doing the same thing when you buy a computer? Aren't you buying simulations and games, data analysis and word processing, graphics and music synthesis and some dreams of new applications?

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In the not-too-distant future you will be able to buy dedicated micros for hundreds of different applications. These devices probably won't even be called computers. Today, however, putting together a system is pretty much up to you. But maybe we can help.

At Creative Computing, we obtain new computer systems, peripherals, and software as soon as they are announced. We put them through their paces in our Software Development Center and also in the environment for which they are intended — home, business, laboratory, or school. We published the first in-depth evaluations of the Texas Instruments 99/4, Radio Shack TRS-80, Ohio Scientific Challenger, Exidy Sorcerer, Apple II disk system, Heath H-8, and APF PeCos I.

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The TI-99/4 has excellent color graphics and costs $1150 including color TV monitor.

Sorting: A Key Technique

While evaluations are important, the main focus of Creative Computing magazine is computer applications of all kinds. Many of these require that data be retrieved or sorted. Unfortunately, most programming texts focus on the bubble sort (or straight insertion) and, very infrequently, another technique (usually delayed replacement) and let it go at that.

Yet, except for comparison counting, the bubble sort is the least efficient. Tutorials and articles in Creative Computing demonstrate that the Shell-Metzner and Heapsort are from 50 to 13,000 times as fast as the bubble sort! Consider a sort of 100,000 items on a DEC System 10:

Bubble sort	7.1 days
Delayed replacement	3.8 days
Heapsort	17.3 minutes
Shell-Metzner	15.0 minutes

Needless to say, on a microcomputer, a bubble sort of even 1000 items is agonizingly long.

Free Sorting and Shuffling Reprint

Because sorting and shuffling (mixing a list of items) is so vital in most programming, we are making available a 20-page reprint booklet on Sorting, Shuffling and File Structures along with our May 1979 issue which has several articles on writing user-oriented programs and making the most of available memory space. The reprint booklet and issue are free with 12-issue or longer subscriptions.

Word Processing: For Home or Business

Word processing is one of the most talked-about small computer applications, but what does this really mean? Four primary areas are served by an effective word processing system: 1) data or text entry, 2) data storage and file manipulation, 3) text editing and 4) formatting, printing and reporting. In our evaluations at Creative Computing, we found that the twelve widely-available micro-based systems vary widely in their capabilities.

We have prepared a 20-page reprint booklet which we will send **free** to new subscribers along with the sorting booklet. Between it and the free May issue, eleven micro-based word processing systems are discussed along with points to consider when purchasing such a system.

At Creative Computing, we believe that computers can be of benefit to virtually every intelligent person in the country. We do not believe that the "Computer priesthood" should confuse and bully the public. As Ted Nelson stated in the Computer Lib Pledge, we do not treat any question as a dumb question, since there is no such thing. We are against computer terms or systems that are oppressive, insulting or unkind, and we are doing the best we can to improve or replace such terminology or systems. We are committed to doing all we can to further human understanding and make computers easy to understand, interactive wherever possible, and fun for the user. The complete Computer Lib Pledge is contained in our May 1979 issue which we are furnishing free to new subscribers.

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Contributing editor Ted Nelson (L) is author of "Computer Lib/Dream Machines." Publisher David Ahl (R) is a pioneer in computer models, simulations and games.

Computer literacy to everyone

The Creative Computing Software Division is participating with Children's Television Workshop in an important new venture, Sesame Place. These theme parks are being designed to bring interactive computer games and simulations to young children (and their parents) and remove the mystique of computers from the youngest segment of our population. In addition, we are participating in projects with several school systems and museums to write reading comprehension and ecology simulations software. We are also involved in a major college-level computer literacy project.

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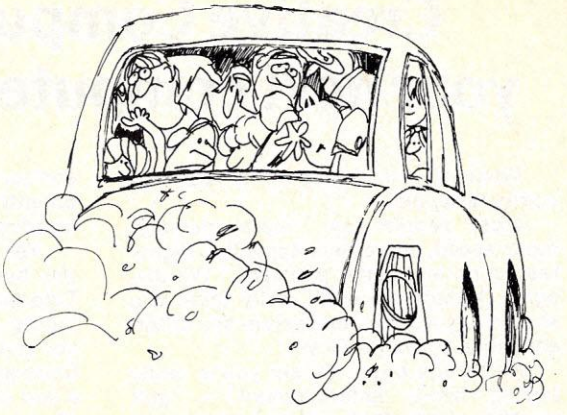
A natural alliance in the "Energy War"

Car Pooling and Personal Computers



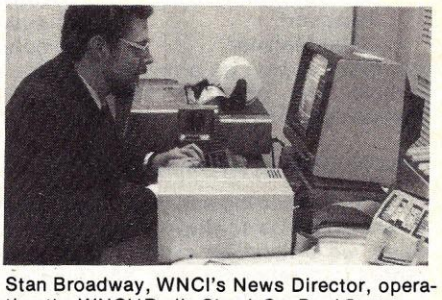
John Craig

Several years ago I was asked if I would be interested in joining a car pool. I rejected the idea because I liked the "freedom" of having my own car available during the day. I've changed my mind since then. Several years ago we weren't paying a ridiculous $1.00, and more, for a gallon of gasoline. Furthermore, the "freedom" and convenience of having a car parked outside each day while I'm working is something I can learn to live without. The day of the car pool has arrived...and we, the personal computing community, can help make it a reality. It makes sense as far as inflation and those absurd gas prices are concerned (i.e., *saving money*), in making a real contribution toward energy conservation and reducing air pollution.

How to pick up intelligent friends.

President Carter made an urgent plea in a recent speech for all Americans to pull together and work toward making our country energy self-sufficient. Whether or not you like Carter isn't very important. Without a doubt, what he said is true... we do have to start pulling together and get things *moving*.

There are tens of thousands of personal computer systems in small and medium-sized towns around the country which could be used for establishing car pools. Through



Stan Broadway, WNCI's News Director, operating the WNCI/Radio Shack Car Pool System.

pleading, coercion and monetary inducements I'm hoping I can get enough owners of those systems interested in this idea to make a significant dent in the problem of energy conservation. It's all very possible, and I'd like to share some ideas on how we can do it. I must admit, however, there is a secondary, ulterior motive for wanting to get personal systems involved in this problem. We can get some good press out of it. The newspapers in all of those small and medium-sized towns will probably help with the effort but in addition will give some good media exposure to personal computing. Eventually the wire services and national magazines will pick up the stories, too. I want to see us do what we can to help with the energy problem but I also want to see personal computing grow and prosper. This kind of exposure can only help meet that end.

Commuter Computer

This idea resulted from a trip I made to Los Angeles recently to do a story on a non-profit corporation called Commuter Computer. The organization was formed during the energy crisis of 1973 under the concept of a regional car pooling system supported by government and private industry. They offer, free of charge, ride-matching services to all residents of the five counties of Los Angeles, Orange, Ventura, San Bernardino and Riverside. They currently have 5.6 million people registered with the system.

I visited the Ventura County offices of Commuter Computer and spoke with Tricia Price, the branch manager. She said the entire project was financed primarily by the California Department of Transportation (CALTRANS). Additional funding is provided by the five county governments from their Federal Aid to Urban Highway Projects funds (FAU), the City of Los Angeles, Southern California Association of Governments, ARCO, Security Pacific bank and others. The annual funding comes to approximately $1.5 million.

When asked what kind of computer was used for the system she replied that she didn't have any idea. She said the Los Angeles City computer serves the system and Commuter Computer is provided free processing time and keypunching. Registration information phoned into the five county branch offices is transferred to a form, shown in Figure 1, which is then forwarded to the LA City computer. Figure 2 is the ride matching information mailed to registrants.

Commuter Computer in Los Angeles is just one of many rideshare systems which have been established in major metropolitan areas around the country. It's obvious from the numbers that big cities are best left to the big systems and large organizations. I hope to make it just as obvious that small communities can be taken care of by microcomputer-based car pooling systems.

Some Of The First Steps

In January of 1979 there was a fire in the Bay Area Rapid Transit (BART) tube which goes under San Francisco Bay. The fire shut down BART, a

Car Pooling, con't...

COMMUTER RIDESHARING REGISTRATION

Important – please complete and return this registration as soon as possible to obtain optimum computer information on commuter ridesharing opportunities.

IF you have recently registered for ridesharing through your employer ridesharing program, do *NOT* complete this registration— pass it along to a family member or friend.

Yes No ☐☐ Have you ever applied to a Commuter Computer ridesharing program before?

PLEASE PRINT all information. Use only one letter per box. Abbreviate where necessary. Be specific in home and work address. Example: Is it a Street (St.), Road (Rd.), Avenue (Ave.), etc? Provide apartment (Apt.) number where applicable.

NAME: Last Name | First Name | Middle Initial

HOME ADDRESS: Number and Street; City; Zip Code; AT

Major street or boulevard intersection nearest your home. (Example: Wilshire Blvd. at La Cienega Blvd.)

☐ Check here only if you do not want your home address printed on ridesharing matchlists.

HOME COUNTY (Check only one)
1 ☐ Los Angeles
2 ☐ Orange
3 ☐ San Bernardino
4 ☐ Riverside
5 ☐ Ventura

COMPANY NAME:

WORK ADDRESS: Number and Street; City; Zip Code; AT

Major street or boulevard intersection nearest your work. (Example: Hollywood Blvd. at Vine St.)

WORK COUNTY (Check only one)
1 ☐ Los Angeles
2 ☐ Orange
3 ☐ San Bernardino
4 ☐ Riverside
5 ☐ Ventura

NORMAL WORK HOURS: BEGIN WORK Hour Minutes (1 ☐ a.m. 2 ☐ p.m. Check one) — LEAVE WORK Hour Minutes (1 ☐ a.m. 2 ☐ p.m. Check one)

EXAMPLE: Show 4:30 p.m. as: Hour 04 Minutes 30 (☑ p.m. Check one) DO NOT GIVE MILITARY TIME.

PHONE NUMBER: Home or work number where you may be reached (1 (213) 2 (714) 3 (805) Area Code (Circle one)) Phone Number — Extension (If Any) ☐ If home phone check here

E I D

NORMAL TRAVEL METHOD: How do you usually travel to work? Check only one.
1 ☐ Auto, Driving Alone 2 ☐ Auto Carpool 3 ☐ Public Bus 4 ☐ Motorcycle
6 ☐ Commuter Van 7 ☐ Commuter Bus 5 ☐ Other _____

RIDESHARING: 1 You will receive free information on regular ridesharing opportunities now available to you, and a list of other interested people who live and work near you.

Yes No ☐☐ Do you have a car available for carpooling? 1 2

COMPUTER USE ONLY
Home Grid
Work Grid
V P I
Yes No PROGRAM
1 2 ___ 10 ___ 12 ___ 15

This information is true and correct. I release it for confidential use in ridesharing. FORM ER-04 3/27-79

SIGNATURE: _____ DATE: _____
Write. Do not print.

Send to Commuter Computer, 3440 Wilshire Blvd., Suite 610, Los Angeles, CA 90010.

Send this application for your free personal Ridesharing Matchlist. It costs you nothing.

Figure 1

computerized rail system, and as a result the freeways coming into San Francisco became quite congested. Ray Schlitzer, Chuck Orr and Bernard Stone of Computerland/San Francisco came up with an idea to help alleviate the problem. They set up an Apple computer with disk, Hitachi monitor and Trendcom printer out on the sidewalk in front of the store and invited passersby to fill out car pool information forms. The forms, which had been run off on the printer, asked for the person's first name, home telephone number, zip codes at work and home, working hours and if he or she preferred to drive or ride. They set it up outside the store because it was felt in order to make something like this work it had to be accessible to people. Apparently they had the right idea because within several days the system contained almost 300 names. The service was free and the registrants were able to get immediate feedback. After entry of their data into the computer it printed a list of other people from their area who were interested in car pooling. The program was improved to provide more accurate information to each person by using a sort of phone prefixes within zip code areas.

This free community service was quite rewarding for the folks at Computerland. They managed to get several hundred people together for car pooling and their enthusiasm was further rewarded by getting some good publicity. The Oakland Tribune did a story on their efforts and Chuck Orr was interviewed for three television news spots, one radio news show and was on a morning radio talk show.

The program has since been discontinued because the Bay Area has an organization similar to Commuter Computer, called RIDES, which is better equipped to handle the growing data base the store was faced with. The Apple system was using a data base program from the local Apple user's group which was limited to only about 500 entries because of a RAM-resident sorting technique. Needless to say, that wouldn't be adequate for most of the applications we'll be considering.

When transportation workers went on strike against the Central Ohio Transit Authority earlier this year approximately 30,000 customers found themselves stranded. Radio station WNCI launched a ridesharing program to get people with cars together with those who normally used the transit system. Stan Broadway, WNCI's News Director, realized after 24 hours that the pencil and paper method of keeping track of people calling in wasn't going to work. He called the local Radio Shack store and manager William Louden loaned them a dual disk TRS-80 with a modified customer mailing list program to put the car pool program into operation. The program did a home zip code to work zip code search and matched up people according to their working hours. Everything was done over the phone. Questionaires weren't sent out to participants nor were lists of the people from their areas. The

Car Pooling, con't...

--- COMMUTER COMPUTER CARPOOL LIST ---

8008001-112
11/11/74

EMPLOYER ID: 11623
MAIL LOC.: 1769

KNOUSE CHARLES
* 716 CHELSEA RD
REDONDO BCH CA 90287

WORK ADDRESS: 100 TEMPLE ST
WORK HOURS: 8:00AM - 4:30PM
PHONE: (213) 378-8652 X Home

HOME MAP SQUARE: 55-145
WORK MAP SQUARE: 45-151
CAR AVAILABLE: YES

NAME	HOME ADDRESS	WORK ADDRESS	WORK HOURS	CAR AVAILABLE	PHONE	LOC/EX
FROM YOUR HOME MAP SQUARE:						
FISHER	RONALD J 4136 ANDREWS PL	100 TEMPLE ST	8:00- 4:30	NO	(213) 860-4545	HOME
GLOVER	MARY	155 N LOS ANGELES ST	8:30- 5:00	NO	(213) 482-6895	HOME
GLORIA	LARRY 14123 SEPULVEDA BLVD	155 N LOS ANGELES ST	8:30- 5:00	NO	(213) 376-8952	HOME
GNANN	WAYNE	155 N LOS ANGELES ST	8:30- 5:00	NO	(213) 482-5339	HOME
FROM OTHER MAP SQUARES NEAR YOUR YOUR HOME:						
OREAR	ROBERT	100 TEMPLE ST	8:00- 4:30	YES	(213) 860-3435	HOME
KNIGHT	DAVID	135 THIRD ST	7:45- 4:15	YES	(213) 378-9895	HOME
FLEER	LILLIAN 3323 W ARTESIA BLVD	300 BROADWAY	8:00- 4:30	YES	(213) 456-8877	HOME
SIMPSON	ARTHER 215 S LUCIA AV	200 N SPRING ST	8:00- 4:30	YES	(213) 485-3325	HOME
KNOX	JOHN 2911 GIBSON PL	300 BROADWAY	8:00- 4:30	YES	(213) 456-9873	HOME
KNOWLES	SIDNEY 822 W 173 ST	220 TEMPLE ST	8:00- 4:30	YES	(213) 456-2323	HOME
FLORES	GLORIA 1614 GOODMAN AV	100 TEMPLE ST	8:00- 4:30	YES	(213) 532-6161	HOME
KNAPP	RICHARD	220 TEMPLE ST	8:00- 4:30		(213) 532-1092	HOME
BUCK	MARTHA 525 SAPPHIRE AV	200 N SPRING	8:00- 4:30	YES	(213) 378-6648	HOME
KNUDSEN	TERRY 532 HELBERTA AVE	125 TEMPLE ST	8:20- 4:45	NO	(213) 620-1970	554
SIGNER	A J 802 S CATALINA AV	155 N LOS ANGELES ST	8:30- 5:00	YES	(213) 482-5522	145
BUNYARD	JIM 649 26TH ST	155 N LOS ANGELES ST	8:30- 5:00	NO	(213) 482-6666	HOME
KNOTTS	ROSEMARY	155 N LOS ANGELES ST	8:30- 5:00	NO	(213) 482-7538	HOME
MARTINO	LARRY	200 N SPRING ST	8:00- 4:30	YES	(213) 485-5028	HOME
GLASS	CHARLENE 87214 PICO BLVD	200 N SPRING ST	8:00- 4:30	NO	(213) 482-9310	HOME
GLOYNE	ELVIN 1512 MONTEREY BLVD	200 N SPRING ST	8:00- 4:30	YES	(213) 485-2323	HOME
GLISTER	JOSEPH 5421 VICTOR DR	250 MAIN ST	8:00- 4:30	YES	(213) 456-1237	HOME
STENEN	SHARON L 703 E ARLINGTON AVE	200 N SPRING ST	8:00- 4:30	NO	(213) 456-8873	928
GLEED	ROBERT 7852 N OARK RD	300 BROADWAY	8:00- 4:30		(213) 372-5258	HOME
GLOWA	DONALD	125 TEMPLE ST	8:20- 4:45	NO	(213) 620-8585	HOME
GLEASON	SUSAN 5542 N SANDS DR	125 TEMPLE ST	8:20- 4:45	YES	(213) 620-7889	HOME

* AT YOUR REQUEST, YOUR HOME ADDRESS DOES NOT APPEAR ON THE MATCH LISTS OF OTHERS.
--- SEE OTHER SIDE FOR ADDITIONAL INFORMATION AND INSTRUCTIONS ---

INSTRUCTIONS AND INFORMATION

FORMING A CARPOOL

The information on your list is provided to help you form a carpool. It is up to you and the others on your list to make carpool arrangements. Here is how you might use this information in setting up or adding to your carpool.

- Examine your list and identify those who would be the best auto-mates for you. Check home address, work address and work hours. Even though the hours listed may be slightly different than yours, adjustments in scheduling may make carpooling more convenient.
- Call potential auto-mates. Check to see if the phone number is a home or work phone and call at an appropriate time.
- Make specific arrangements: who will drive and what days, where you will meet, time of departure, and expenses to be shared.
- Agree on: what will happen if someone is late, what should be done in case of illness or change of plans.
- Discuss other considerations: the type of car, the route to be traveled, adequacy of insurance coverage and personal preferences such as smoking, type of music, etc.
- Save your list for future reference. You may want to add others to your carpool in the future. Also, you can use the top portion of this list to make deletions, request new lists and to make corrections.

REMEMBER those on this list are also interested in forming a carpool. So go to it. **JOIN A "76 POOL"!**

DELETIONS

If you wish your name to be removed from the carpool data file, check the appropriate box above, detach the upper portion of this page and mail it to Commuter Computer.

NEW LIST REQUESTS

If you feel that the match list from your initial request is not satisfactory, and you would like to re-apply, do not fill out a new application form, but check the appropriate box above, detach, and mail to Commuter Computer. A second list will be sent to you, which might contain additional names not available when your first request was answered. Your request for a second list should not be made immediately after receiving the first list, because time will be needed to get other people into the system. Thus, you should wait at least a month before submitting a new request.

CORRECTIONS AND REVISIONS

The people on your list were matched with you using the information you provided. If the matching information is incorrect, or you wish to change some of the data, check the appropriate box above, and make the change directly on the reverse side by crossing out the incorrect information and printing the correct data. Detach the upper portion and mail it to Commuter Computer.

INSURANCE COVERAGE

Please check with your individual insurance agent to see if you are adequately covered for carpooling and if your insurance coverage will be affected in any way as a result of carpooling.

Figure 2

Car Pooling, con't...

system was capable of handling approximately 600 entries.

With the settlement of the strike the system was eventually retired but the success of the program has encouraged the city of Columbus to set up a permanent car pool system to help in conservation and traffic reduction. An interesting side note is that Bill Louden has received requests for copies of the program from several sources, including the Michigan Transportation Authority, who wanted to adapt it to a larger system. The idea of someone actually doing that seems farfetched but it does indicate a real interest exists.

Population and Area Considerations

I only wish that I had had a car pool system in operation for a period of time and could relate the actual problems encountered in setting one up. Unfortunately, that's not the case. I have, however, put together some examples (using a dummy data base) which should provide some ideas on how to attack the project.

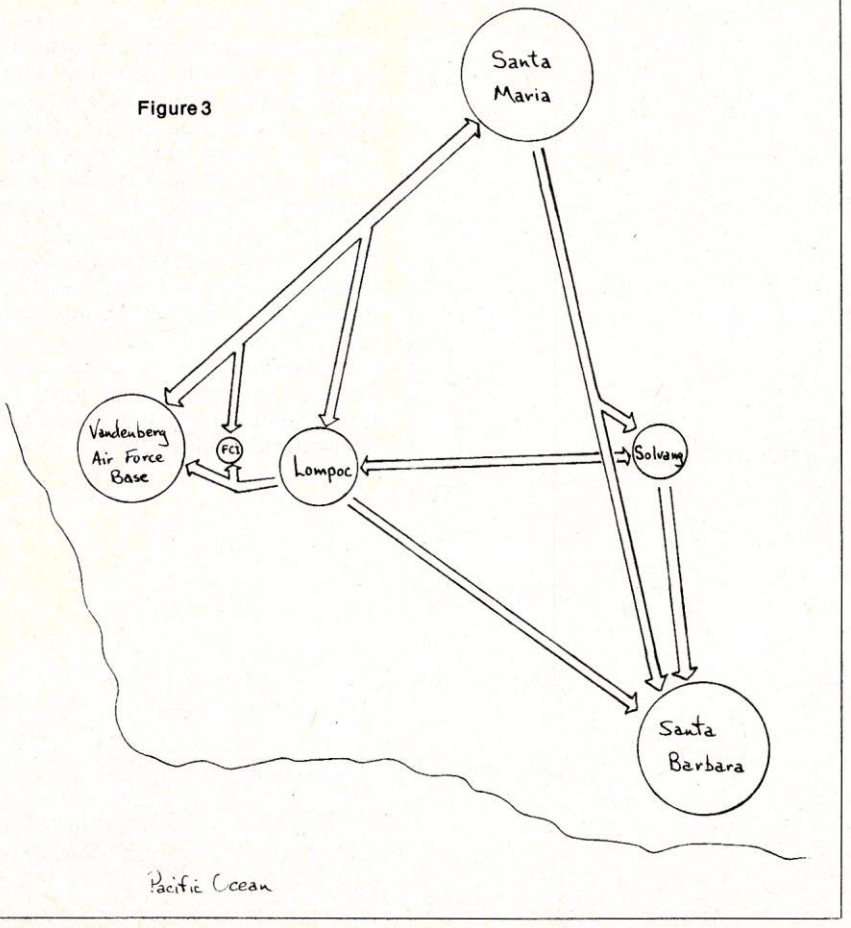
Our primary "model" will be based on a section of the Central California Coast consisting of the cities of Santa Barbara, Solvang, Lompoc, Vandenberg AFB and Santa Maria. We'll assume the system is somewhat centrally located, in the town of Lompoc (population 25,000). Figure 3 is a diagram of the cities illustrating the possible "commuting paths."

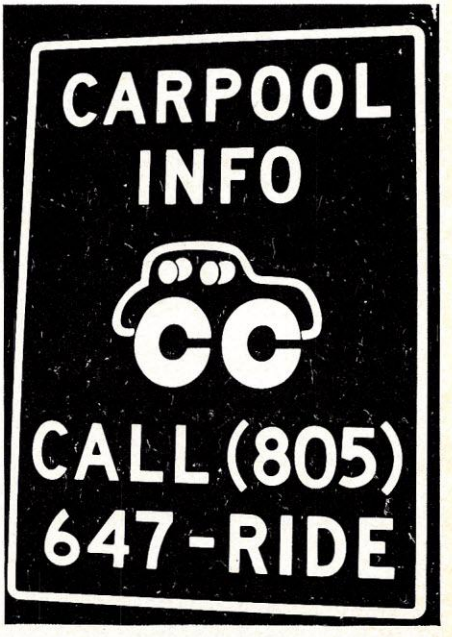
Lompoc is a city with two or three industries which attract few people from other cities. Most of the people working for those companies live in Lompoc. A large number of people from Lompoc work at Vandenberg Air Force Base which is 15 miles away. There are also a couple of hundred people from Lompoc who work at the Federal Correctional Institution (FCI). Several companies in Santa Maria, Solvang and Santa Barbara also attract people from Lompoc. The path between Lompoc and Santa Maria (30 miles) is bi-directional but is pretty much one way from Lompoc to Santa Barbara (50 miles). This is because the cost of living and housing is so expensive in the Santa Barbara area that many people live in Lompoc, which is somewhat lower, and commute. These people are prime candidates for car pooling. Santa Barbara also attracts people from Santa Maria and the town of Solvang. Solvang is a Danish "tourist" community, also with a high cost of living, and many people working in the stores and shops come from Lompoc and Santa Maria. Some of the people living there commute to Lompoc, Santa Maria and Santa Barbara for work.

There we have a simplified look at the demographics of the area. You should start thinking about the same things with regard to your community and neighboring towns. The next step is to get a map of the area and break it up into grids. The map in Figure 4 has the area broken up into 21 sections (A thru U). This is fine for getting the "big picture" but maps of the individual towns will be needed to identify exactly where people live and provide identification of boundary lines. It's important to break each community out in a grid by itself so that one area, or grid, doesn't try to encompass too large a population.

Perhaps your reaction, after looking at Figure 4, is that the area and population is too great for a floppy disk-based micro to handle? I don't think so. Keep in mind that many of the small communities being served are in fact fairly small communities. According to Commuter Computer,

Figure 3





Car Pooling, con't...

the percentage of a community's population which registers for a program such as this is usually difficult to determine. Some cities might have as much as 70% of the population commuting each day and others might have 70% of the population working in that city. However, for our purposes we need to come up with some kind of "guesstimate" so we'll have an idea of whether we're getting in over our heads or not. With that in mind, let's assume that 10% of the total population will register for the system (and as gas availability decreases, that percentage increases). The folks at Commuter Computer told me that was a realistic figure for the maximum estimate. The total population of the area we've been discussing is approximately 101,500 (which doesn't include Santa Barbara since most of the commuting will be into that city). This means we can expect a maximum of approximately 10,150 people to register for the program.

As an example of a much smaller "model" let's consider the small town of Tularosa in southern New Mexico. Tularosa has a population of 3,500. Many of its residents work in neighboring Almogordo, a distance of 12 miles. Some drive up into the mountains to work at the race track and other industries in the city of Ruidoso. Others commute to Holloman Air Force Base and White Sands Proving Grounds (40 to 50 miles). A very small system could handle the task if only 350 residents (10%) of that sleepy little town registered for car pooling...and there would still be a lot of gasoline saved each day. With these samples in mind, let's take a look at some of the data requirements and the kind of software needed for the job.

JOIN THE GASPAYERS' REVOLT

System Requirements

Without a doubt, the system must have a minimum of dual floppy disks or high-speed cassettes for external mass storage. For some applications a mini-disk system will be adequate. Others will require a standard 8" disk system. Going beyond that we have double-density, quad and perhaps even hard disk systems.

Before we get into the various storage systems, and their capacities, we should define the data we'll be dealing with. The heart of this whole system, particularly because it's micro-based, is going to be the mass storage. People aren't going to take this idea seriously unless we can come up with some sound figures on just what a micro system can do. And, as we'll see, convincing "them" will become important when it comes time to try to obtain financing. Because most floppy disk systems are relatively low in capacity (relative to hard disk systems) it's important that we define our data in a frugal and miserly fashion...with the objective of getting as many records as possible onto a diskette (one record being all the data from one registrant).

The big systems, such as Commuter Computer, aren't as concerned with storage requirements as we are and as a result are able to offer their "customers" more than we can. Our objective should be to come up with the least number of characters possible for a single record. With that in mind, refer to Table 1 and we'll see what can be included...and what can be left out.

Table 1 defines the fields for a complete record, with the objective of coming up with a maximum length of 64 characters. There were a couple of things which had to be deleted in order to meet that objective. The home address and major intersections near the registrant's home along with the work address were the main things to go. A person signing up for the ride matching service is primarily interested in getting phone numbers of other people in her area. Most of the coordination is done over the phone...and there's no reason why the party at the other end can't provide a home and work address.

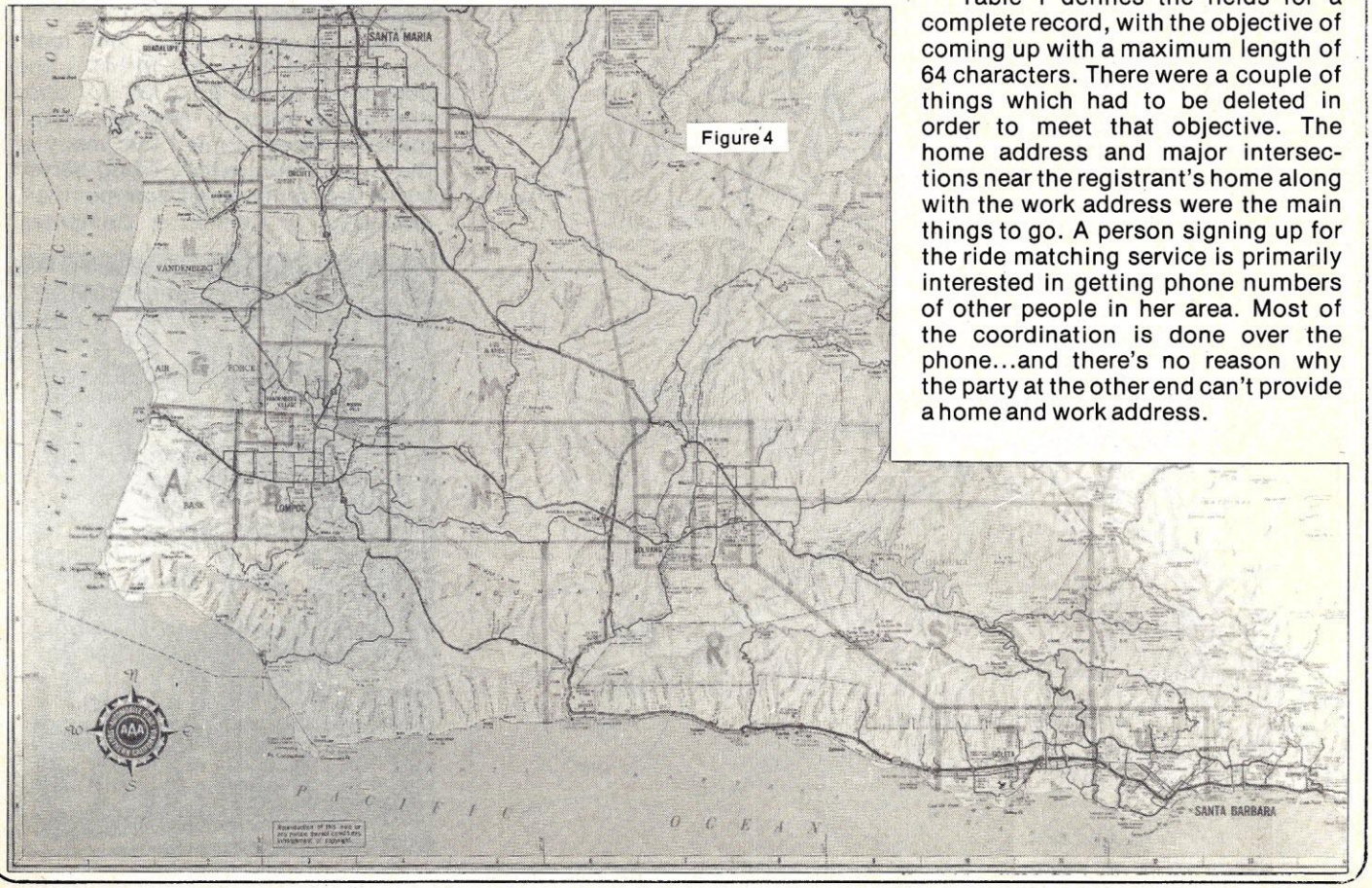


Figure 4

Car Pooling, con't...

Field	Number of Characters
Last Name	17
First Name	11
Phone Number	10
Home or Work Phone?	1
Work Starting Hour	4
Word Ending Hour	4
Days of Week	1
Category (Drive, Share, Ride)	1
Home Map Grid	1
Work Map Grid	1
Field & Record Separators	11
Total Characters	62

Table 1. Field lengths and specifications for a 64-character car pool registrant record.

17 and 11 characters for last and first names, respectively, are more than adequate. Inclusion of the area code in the phone number would be advisable since some places border on two different codes. The program could convert the work starting and ending hours to military time, saving two bytes to specify AM or PM. The days of the week can be stored as a single, encoded byte. The home and work grids could be deleted and the person receiving the information would have to assume that the data dealt with someone from his area. However, the grids probably should be included as a good psychology measure. (It would be a good idea for the person to have a map, such as the one in Figure 4, to refer to when filling out the application form, and for later reference.) The field and record separators bring the total characters per record to 62.

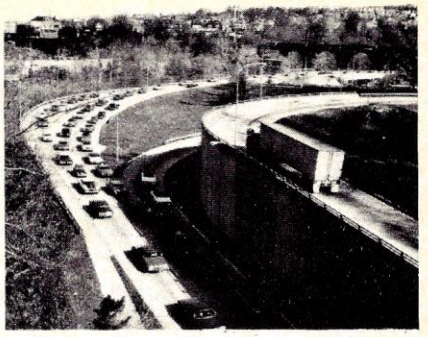
Table 2 lists the storage capacities for various single-density mass storage systems available for personal computers. Using the 8" CP/M entry as an example, the figures were arrived at by multiplying the number of tracks by the number of sectors to obtain the total number of sectors. This was then multiplied by the number of data bytes (i.e., a formatted diskette) per sector to obtain the total bytes per media. The first drive usually contains the operating system, directory and the car pool program (arbitrarily set at 4K - either assembly language or BASIC) which are totalled up under "1st Drive Overhead." This overhead is then subtracted from the total capacity to yield the "1st Drive Capacity." That figure is added to the "2nd Drive Capacity" to obtain the "Total Capacity." The total is then divided by 64 (the length, in bytes, for each record) to provide the "Total Number of Records." The various media have been listed in descending order and the Radio Shack TRS-80, partly because of its tremendous overhead, comes in last.

The purpose behind this exercise has been to provide data for determining the type of micro system, and mass storage, for different population level car pool systems. The 10% figure arrived at earlier for the California Central Coast area (10,150) would require that we look at a system capable of handling that amount of data...and provide for future expansion. An important point to keep in mind is the cost-effectiveness of adding a third, and some cases fourth, drive for increased storage. More importantly, however, is the absolute necessity for having a car pool program which allows for such expansion.

There are a number of systems on the market using the 8" version of CP/M (and also a few 5" mini versions). The Beta-1 and North Star disk drive can be adapted to several systems. The table isn't all-encompassing, especially since it doesn't include prices, but should serve as a guideline in system selection.

One of the objectives of this article is to call upon the readers of Creative Computing to develop car pool programs for various systems and submit them for publication. We would like to see as many systems established around the country as possible and sharing such programs through the pages of Creative will help accomplish that goal. Suggested specifications for the program are listed in Figure 5. A most important consideration is that the data entry portion of the program have a lot of human engineering and be very forgiving (which is actually important criteria for *any* program). The printout of data, shown in Figure 6, should also be easily read and understood by those using it.

There are some existing data base programs which could be adapted for this application. Figure 7 is a



printout, which would be sent to an applicant, of some dummy data using the CP/M version of WHATSIT. The data is based on the California "model" discussed earlier and uses map grids from Figure 4. This particular data base wouldn't be the most efficient for most applications...but would certainly work for some. One of the biggest problems in implementing it would be the necessity for the operator to use great care in entering all of the information (the entries are lengthy). The overhead for the CP/M version is also fairly steep; 2 bytes for CR & LF for each 128 byte sector plus 18 bytes per entry for pointers along with a startup overhead of 4K on the 1st drive. On the other hand, WHATSIT uses variable length fields, rather than fixed, and is efficient in that respect. If you implement a car pool system using this data base, or something else, we'd like to hear about it.

Funding: The Unanswered Questions

My original idea was to appeal to schools, computer stores and individuals to form car pools with personal computers as a public service. In some cases, that will be possible. However, a lot more people will get fired up about the project if they can receive funding for their efforts. (I'd really like to see "Grey Power" get involved in this. It seems that such a project would be quite interesting for retired and/or elderly persons in hospitals, homes and retirement hotels and communities.)

On the matter of funding we have a slight problem. If this was some kind of a welfare program we could very likely get funds from the federal and

How to get 80 miles per gallon.

Car Pooling, con't...

System	Tracks	Sectors	Data Bytes/ Sector	1st Drive Overhead	1st Drive Capacity	2nd Drive Capacity	Total Capacity	Total Number of Records
Beta-1 Hi-Speed Cassete (MECA)	2	1000	256	5,120	506,880	510,976	1,017,856	15,904
Radio Shack Model II	77	26	256	70,600	425,000	480,000	905,000	14,136 *
Micropolis Mod II	77	16	256	16,384	299,008	311,296	610,304	9,536
8" CP/M Ver 1.4	77	26	128	12,800	248,152	247,552	495,704	7,745
Commodore PET	670 Blocks		256	4,096	167,424	171,520	338,944	5,296
Compu-Think (PET)	40	16	256	8,192	155,648	159,744	315,392	4,928
Micropolis Mod I	35	16	256	16,384	126,976	135,264	262,240	4,097
Apple DOS 3.2	35	13	256	17,408	99,072	113,152	212,224	3,316
Heath CP/M (Lifeboat)	40	20	128	11,776	90,624	94,720	185,344	2,896
North Star Release 4	35	10	256	7,168	82,432	89,600	172,032	2,688
Heath H8 HDOS	40	10	256	27,187	75,213	94,208	169,421	2,647
Radio Shack TRS-80 (DOS 2.2)	35	10	256	30,000	55,000	85,000	130,000	2,031

Notes:

1.) The Beta-1 requires 1,024 bytes for directory. Operating system is in EPROM. (Access time for this system is 34 seconds worst case and 10 seconds average.) Double density option available.

2.) 8" CP/M - Tracks 0 & 1 are reserved for DOS on all diskettes. Double and quad density versions available.

3.) North Star - DOS Release 4.0 occupies 3,072 bytes. Double and quad density versions available.

4.) Apple - Tracks 0, 1 and 2 are dedicated to the DOS and track 17, on all diskettes, is reserved for directory.

5.) Both the Compu-Think and Commodore systems have the operating system in PROM. The directory overhead has already been subtracted from the 670 blocks listed for the PET and 1 track is used for directory on the Compu-Think.

* 6.) TRS-80 - Model II is available only in double density version. The overhead for Model I and II is quite high because the BASIC and several utilities are included along with the DOS and the 4K car pool program. Rounded off figures were supplied by Radio Shack and have slight discrepencies.

7.) There are a number of systems with mini-disc drives available on the market which will have capacities similar to the other mini drives listed.

8.) REMEMBER: Capacity isn't everything. Some of the systems listed above are quite easy to use, both from the programmer and end-user standpoint, and some are very poor. In addition, some systems have much more software available than others.

Table 2. Data capacity for various single density personal computer mass storage systems. 1st drive will contain overhead, consisting of the DOS, directory and the car pool program (assumed to be 4K in all cases) with remainder allocated to data storage. 2nd drive for data storage only. Total number of records is based on 64-character records. All values are expressed in decimal. In most cases, double density and quad density values can be determined simply by multiplying the single density "Total Number of Records" figure. That approach is not always accurate, particularly with standard 8" CP/M systems, due to varying formats from one manufacturer to another and the lack of standards.

state governments without any problem. If it was to study a problem, rather than offer a solution, we could probably obtain funding, also. I've never had any dealings with the self-perpetuating bureaucracies of the federal government and after the experience of trying to get some answers to my questions on this matter, I'm not sure I'll ever want to again. In all fairness, I did run across some conscientious individuals on both the state and federal levels who were very helpful. Unfortunately, the people I thought could provide the most help were the least helpful. For example, a Mr. Lew Pratsch, with the Department of Energy, is in charge of Car Pool and Van Pool Programs. I tried calling him several times... couldn't get a return call...and was finally told that he was "tied up with a project for the White House." His phone number is (202) 376-4436.

Things weren't much different with the Department of Transportation...which is where I was hoping to finally find some light at the end of the tunnel. The Department of Transportation, through the Federal Highway Administration, has divided the country up into 10 regions. There are offices in major cities in each of those regions and district offices in each state capital. The counties and cities in each state which have populations exceeding 200,000 are required by the federal government to establish Metropolitan Planning Organizations (MPO). These MPO offices may be a starting point for us...I hope.

One of the major objectives of this article was to provide guidelines and exact procedures for going after funding for a car pool system. Unfor-

Car Pooling, con't...

```
      Whatsit?
GRID B TO GRID F
      GRID B TO GRID F's CARPOOLER's GEORGE THOMPSON
      GRID B TO GRID F's CARPOOLER's ALYCE BEEBE
      GRID B TO GRID F's CARPOOLER's HOWARD LUKK
      GRID B TO GRID F's CARPOOLER's PETE BICKERDIKE
      GRID B TO GRID F's CARPOOLER's DAVID BRYANT
      That's all!

      Whatsit?
GEORGE THOMPSON
      GEORGE THOMPSON's PREFERENCE's SHARE DRIVING
      GEORGE THOMPSON's WORK ADDRESS's SAMTEC, BLDG 7000, VAFB 93437.  PH 800-5444.  HOURS: 8AM - 4:30PM.
      GEORGE THOMPSON's ADDRESS's 817 N. F ST, LOMPOC 93436. PH 555-1000.
      That's all!

      Whatsit?
ALYCE BEEBE
      ALYCE BEEBE's ADDRESS's 4400 W. LEMON, LOMPOC 93436.  PH 666-3434.
      ALYCE BEEBE's WORK ADDRESS's FEC, 415 NEW MEXICO, VAFB 93437.  PH 788-2000.  HOURS: 8AM - 5PM.
      ALYCE BEEBE's PREFERENCE's SHARE DRIVING
      That's all!

      Whatsit?
HOWARD LUKK
      HOWARD LUKK's ADDRESS's 3277 LOMPOC-CASMALIA ROAD, LOMPOC 93436.  PH 333-7000.
      HOWARD LUKK's WORK ADDRESS's BENDIX, BLDG 640, VAFB 93437.  PH 455-1234.  HOURS: 4PM - 12:01AM.
      HOWARD LUKK's PREFERENCE's RIDE ONLY
      That's all!

      Whatsit?
PETE BICKERDIKE
      PETE BICKERDIKE's ADDRESS's 58 N. A ST, LOMPOC 93436.  PH 554-7777
      PETE BICKERDIKE's WORK ADDRESS's SAMTEC, BLDG 7000, VAFB 93437.  PH 800-6666.  HOURS: 8AM TO 4:30PM.
      PETE BICKERDIKE's PREFERENCE's DRIVE ONLY
      That's all!

      Whatsit?
DAVID BRYANT
      DAVID BRYANT's ADDRESS's 666 S. FIR ST, LOMPOC 93436.  PH 555-3333.
      DAVID BRYANT's WORK ADDRESS's BOEING, BLDG 4500, VAFB 93437.  PH 800-6777.  HOURS: 8AM - 4:30PM.
      DAVID BRYANT's PREFERENCE's SHARE DRIVING
      That's all!
```

Figure 7. Sample printout using dummy data and WHATSIT data base system.

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CIRCLE 163 ON READER SERVICE CARD

Data Entry

1. All entries should be preceded by self-explanatory prompting messages to minimize operator training and system documentation.

2. Program should have a menu for selecting the following operations:
   (1.) ADD NEW ENTRIES
   (2.) DELETE OLD ENTRIES
   (3.) CHANGE OLD ENTRIES
   (4.) SORT DATA
   (5.) SEARCH FOR MATCH
   (6.) PRINT RIDE-MATCHING INFO
   (7.) MAKE BACK-UP COPIES OF DISKETTES
   (8.) EXIT SYSTEM

3. Incorrect entries or failure to mount data disc should not cause system to crash. Error trapping techniques should be employed throughout.

4. Instructions for initializing system, sorting data, making backup copies of diskettes and performing orderly shutdown should be displayed on screen, whenever possible, and clearly described in user's manual.

Data Processing

1. Program should be designed for accepting data during the day, sorting the data at the end of the day, then performing the necessary ride-matching searches followed by the generation of printouts to be mailed to applicants.

2. Searches should be from home grid to work grid and also search the grids passed through by the applicant going from home to work. Searches should also be performed in grids surrounding the applicant's home grid to provide an even higher number of potential matches.

3. It shouldn't be necessary to search for compatible work starting and ending hours since the person using the list will be able to eliminate those not matching.

4. System must be designed for expansion of external mass storage (i.e., adding additional drives).

Data Output

1. Optional vertical or horizontal output formats would be desirable so that standard 80-column printers can be used or inexpensive 40-column printers.

2. Data should be easily understood and accompanied by explanatory messages, if necessary.

And...it will undoubtedly be larger than 4K.

Figure 5

```
Patti Fortenbaugh
Home phone number is (805) 555-3434
Begins work at 8:00 AM
Ends work at 4:30 PM
Works M,T,W,TH,F
Drives
Home map grid is F
Work map grid is A
```

Figure 6. Sample printout of a single record of the car-matching data sent to people registering for car pool program (based upon data from Table 1.

tunately, I haven't come close to meeting that objective. Several fruitless attempts have been made to get in touch with the people in the Department of Transportation who could provide that information. Once again, it's a matter of someone not being in (on several occasions), leaving a message...and never hearing from them. The completion of this article was held up for days on end while attempting to get that information. However, I do have some suggestions on who to contact on this matter. Needless to say, we would be very interested in hearing about your successes (and failures, if they're constructive).

Ms. Barbara Reichart is Chief of the Ride-Sharing Transportation Branch in the Federal Highway Administration (HHP-33, Washington, DC 20590). Her phone number is 202-426-0210. Another person in that office who might be of assistance is a Mr. Radman. They should be able to give you information regarding the Metropolitan Planning Organization in your area and, hopefully, the steps to take in applying for funding through the Department of Transportation. I don't honestly know if they'll be of any help because I was unable to get through to either of them (or they were unable to get through to me). Another avenue is going directly to the state level to see what is available there. There are also city and county governments which might be willing to fund such programs. Corporations and private institutions are other areas to explore. Many of the readers of Creative are knowledgeable about going after such funding. Hopefully, they'll share the tricks of the trade with the rest of us.

RIDES for Bay Area Commuters, Inc.
100 Van Ness Avenue, 19th Floor
San Francisco, CA 94102

CarShare Program
Metropolitan Transit Authority
P.O. Box 61429
Houston, TX 77208

Commuter Computer
3440 Wilshire Blvd., Suite 610
Los Angeles, CA 90010

Table 3. Addresses of three of the larger, metropolitan car pooling organizations.

Summary

It's one thing to develop a program, but another matter to successfully market it. And, anyone applying for funding will sure have to demonstrate they can handle the promotion. The public can be made aware of this kind of program through newspaper ads, radio spots and highway signs (which have been very successful). One of the most effective methods has been to enlist the aid of corporations and provide application forms for their employees to fill out. (Actually, there is probably a "market" for selling this idea to a company for in-house use.) There will be a lot of public relations and marketing involved in such a program; people need to be made aware of the advantages, need to overcome the fears associated with joining a car pool and much more. Different ads and radio spots should help accomplish that. Getting to know the demographics of the typical car pooler will be important and much of this information can be obtained from the larger, established systems (e.g., CarShare, in Houston, has found that almost 70% of the participants are female). The newspaper published by Commuter Computer in Los Angeles contains a wealth of ideas. Table 3 lists the addresses of three of the larger systems.

The price of gasoline won't be coming down. People are surely beginning to feel guilty about driving around in those 2-ton gas-eating monsters *by themselves*. Plus, they must be feeling pretty dumb spending all that money. We have the technology to help bring ride-sharing programs to every corner of the country. Let's do it. □

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- ☐ 8-in. Winchester hard disk, 10 Mbyte drive
- ☐ 8-in. Floppy drive Single sided Double sided
- ☐ Double density expansion interface

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

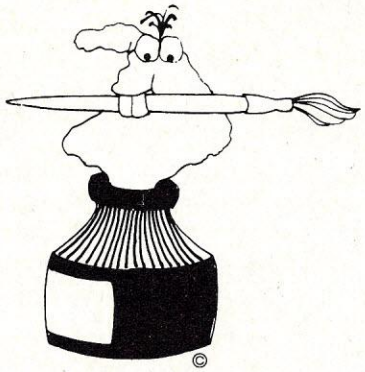
Phone No. _____

If dealer, provide resale no. _____

*TRS-80 is a registered trademark of Radio Shack, a Tandy Company.

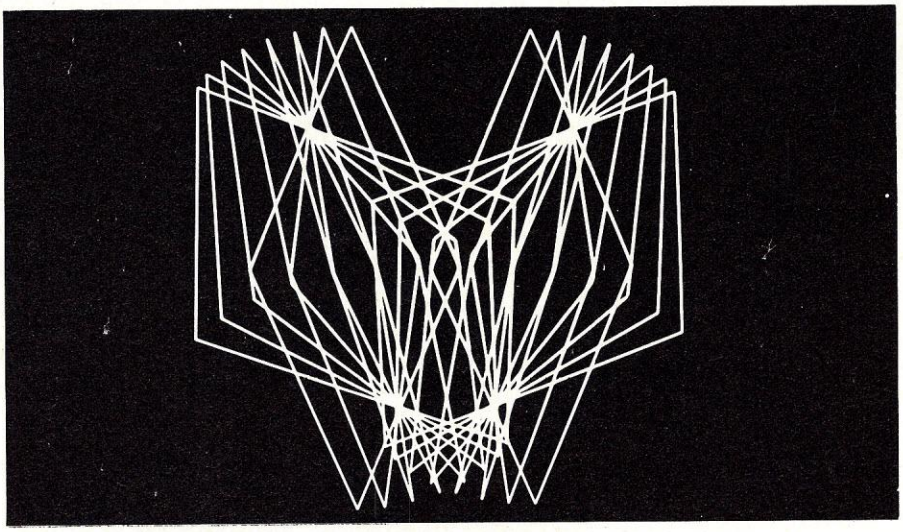
CIRCLE 160 ON READER SERVICE CARD

Computers As Media At Westlake Gallery

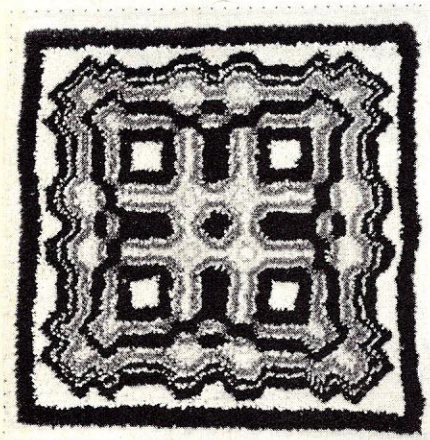


Cathy Westlake

"So, the computer is taking over art," was the first testy remark of many visitors who had never before seen such work. The problem voiced by a small and sophisticated group of collectors was, "which works are suitable for the best investment?" Two unusual responses to an art show, but then the exhibition of computer generated art at Westlake Gallery at 210 East Post Road in White Plains, New York was an unusual one for a profit making gallery in the metropolitan area.



Frame from the film "Graphic Music" by Herbert W. Franke.

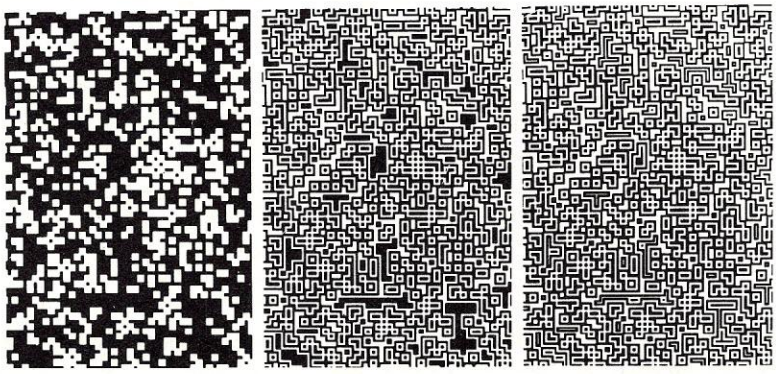


Untitled acrylic hooked wall hanging/rug designed by William H. Apgar and handcrafted by Sybil Watts.

The responses are significant. At the annual "Wood" show, no one suggested that art is being taken over by wood. When a group of innovative clay and paper wall constructions all but sold out in the spring, none but a few of the unsuccessful artists growled that painting is dead. The curator and the artists were pleased with the sales of the computer related art. In gallery terms, they were adequate. On the other hand, with seasoned collectors being joined daily by hundreds of new collectors, all eager to demonstrate the kind of insight into innovative art that will beat inflation, the fact that more collectors did not buy deserves to be looked at.

"COMPUTER: ARTIST - ARTIST: COMPUTER," as it was called, was an exhibition of works by fifteen artists, installed in the spacious main gallery, sixty feet long and sixteen feet high. Curator Carl Machover, computer graphics expert, selected many of the most prominent artists to show in this relatively new field. His aim was toward presenting the widely varied field of creativity possible with computers. The installation went international with contributions from William Apgar of Canada with two colorful wall hangings; Tony Longson of England brought two unusual wall relief sculptures and several series of drawings; and Herbert W. Franke of West Germany sent an elegant series of abstract graphics.

Cathy Westlake, 210 East Post Road, White Plains, NY, 10601.



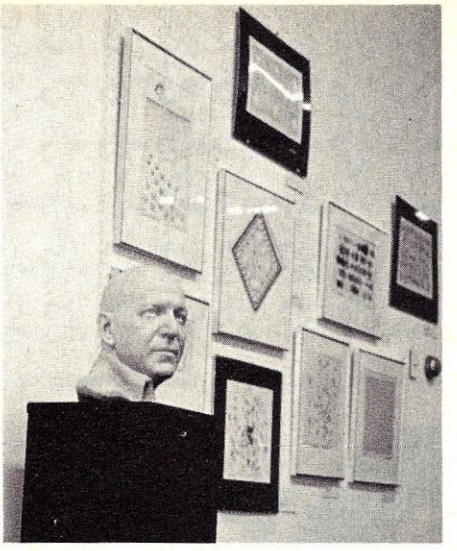
Contours inside and outside scattered boxes, a graphic by Ken Knowlton.

Computer Media, con't...

Works from the United States ranged from intricate graphics by Ken Knowlton, to a bold, four part abstract acrylic painting by Ruth Leavitt and Richard Helmick's hand printed colorful, rhythmic, silkscreened landscapes. Everyone enjoyed the humor in William Kolomyjec's "Banana Cone," a drawing in which the computer provides transitional visual steps of recomposing the image of a banana into an ice cream cone.

The critics approved. Kathie Beals, Arts Editor of the county-wide Westchester Gannet papers, wrote, "This is legitimate stuff: witty on occasion, striking in form, brilliant in color. You can relate to it exactly as you do to any other nonromantic work of art." Connie Winkler wrote in Computerworld, "It's a fun display of intense lines, bright acrylics, geometric weaving and a formica sculpture designed especially for the show and gallery."

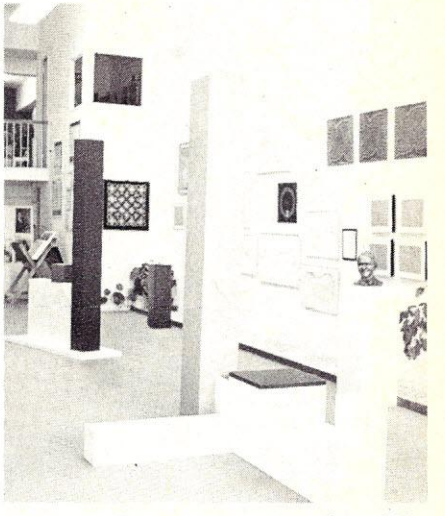
"Sculpture by Solid Photography," a firm using a unique computerized system to "replicate" a person's head in sculpture, arranged a graphic visual display to help answer the hundreds who asked, "How can they do it?" A representative, Walter Dygus, presented an evening talk and discussion on the sculpture and other applications of Solid Photography.



Full size sculpture of Telly Savalas in bonded marble by Sculpture by Solid Photography with graphics by William Kolomyjec in the background.

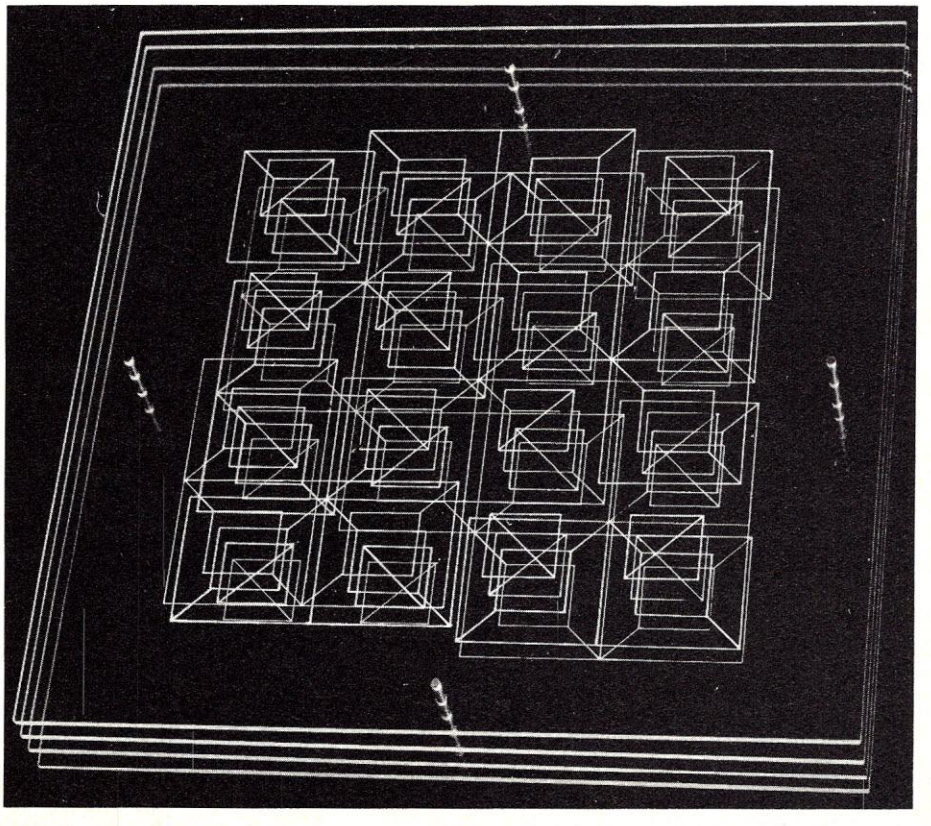
These sculptures and their installation are central to the direction exhibitions should take to overcome the resistance of the public, both naive and sophisticated, to this medium. The artist, Robert Mallary, of the University of Massachusetts, was well established as a professional before he began working with computers. He is also a teacher. To compliment his sculpture, he constructed eight panels of verbal and visual material explaining "process." In this presentation, he achieved a careful balance of information understandable to the lay person and interesting to the hundreds of computer users who live and work in Westchester.

The evening was one of nine special programs presented in the Gallery during the exhibition. Each was organized with the enthusiastic and generous support of specialists involved with computers in many areas. There were three evenings of computer related music organized by Elias Tannenbaum, prominent composer and teacher from Westchester, and by the members of SONAVERA Studios for the Sonic Arts in Hawthorne, New York, Lejaren Hiller sent tapes and records of his compositions from the State University of New York in Buffalo; Carl Machover orchestrated a program of video tapes and films from throughout the United



"WESTLK 4," computer generated modular formica sculpture by Robert Mallary. In the background are wall sculptures by Tony Longson, and "2 x 2," painting in acrylic by Ruth Leavitt.

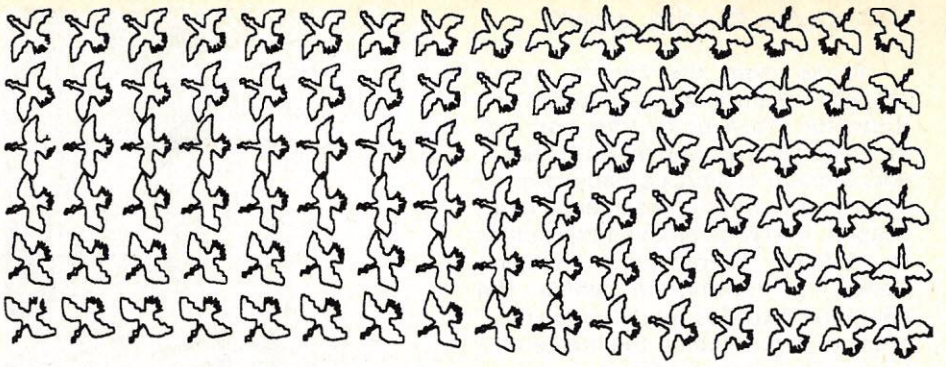
States. A local audio-visual firm sent advanced equipment for projection and sound of the works under discussion. Hewlett-Packard sent their Desktop Computer System 45B and four color pen plotter, the 9872A and William Kolomyjec translated several of his programs for that equipment. Hal Shair of The Computer Corner of White Plains made a valuable contribution by demonstrating the graphics of Apple II with SOL, a small computer running the Electric Pencil and an accounts receivable program from Peachtree. Through the juxtaposition of a graphics oriented computer with one that does the verbal and mathematical functions affecting our daily lives, the audience gained an understanding of both. There was also a heated discussion on "Computer Coping" and a thought



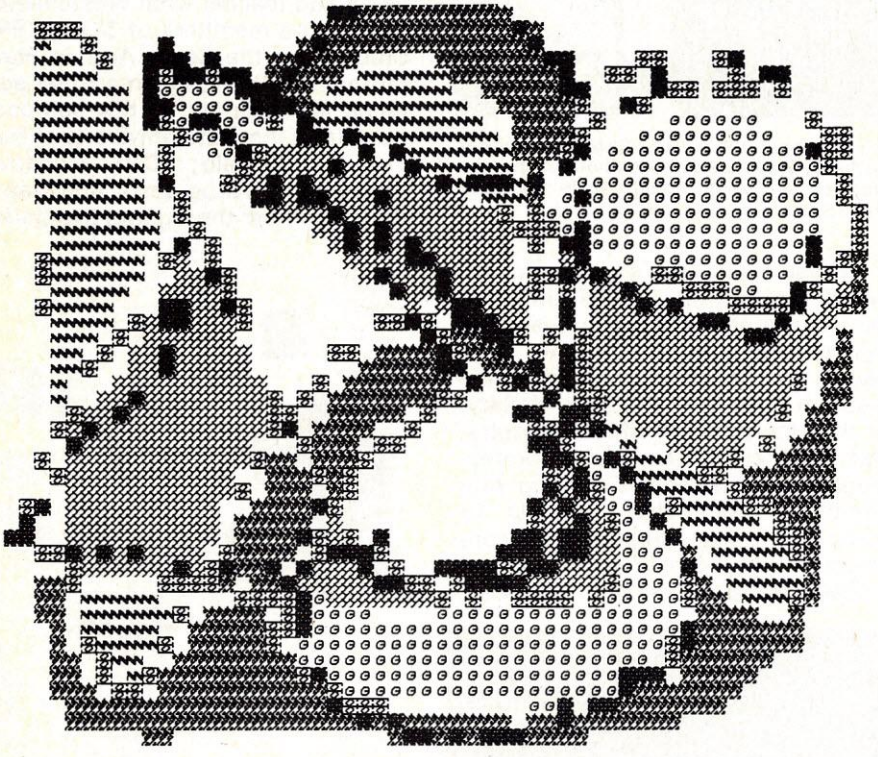
"Group Theory Grid," a perspective sculpture by Tony Longson.

provoking round table on the art itself. Through the combination of elements, a fearful curiosity was transformed into enthusiastic fascination.

Throughout the exhibition, individual viewers and audience members expressed a real fear of computer "takeover" of the artist's field. The fear is predominantly based on frustrating billing errors in which a company is blamed, rather than the programmer, for mistakes. Rumors of vast banks of personal information stored away somewhere, with the threat of a controlling and manipulating "Big Brother" computer, also contribute to this fear.



A portion of "Birds," a plotter graphic by William Kolomyjec.



"Herringbone Variation III," a serigraph by Ruth Leavitt.

Relaxation was evident as people read Robert Mallary's essay or heard that, while the design for Apgar's hangings were computer generated, the hangings themselves were made by hand. Seeing the process of selection and aesthetic judgment exercised by an artist as the operator stopped and started Kolomyjec's programs on the Hewlett-Packard plotter, was reassuring. Hearing visual artist's such as Ken Knowlton and musicians, such as Dary John Mizelle agree that the computer is a tool or medium that is only as aesthetic, or as ethical, as its programmer, was soothing. The show and the programs not only gave people an understanding of the art involved, they also gained insights enabling them to cope with the impact of computers in their daily lives in a more relaxed way.

There were related problems for the collector. The computer as medium conjures up the image of a person in business dress pushing buttons, ensconced in an ivory tower, far from the world of art. Will that artist blossom, or are these works only a temporary experiment? Can lines on a plotter be compared to a drawing? And, with the infinite reproductive talents of the computer, will the graphics artists stick to numbered editions which give graphics their value, or will the same spurious editions appear in this field that have in recent years done great damage to the graphics market in general?

The seriousness of the works on view helped to dispel these doubts. The inclusion of artist such as Mallary, Ruth Leavitt and Colette Bangert, well established as professionals before the advent of computers, helped. We also offered for sale the book "Artist and Computer," edited by Ruth Leavitt, which contains essays by many of the artists in the show. In each, clearly, is a drive to succeed, an enthusiasm and an integrity that leave little room for doubt.

The remaining question is price. Those artists sold whose work was comparably priced with other graphics, drawings and sculpture on the art market today. The greater the reputation, the higher the price, as is true with art in general. However, any computer artist who is so zealous as to feel that his computer generated art is more valuable than art in another medium, will not succeed. As computer generated art gains more popularity, it will be as art that is innovative in technique and style and important in statement. Great talent and understanding will continually expand the boundaries of new media offered by computers.

We were hesitant about this exhibition until Carl Machover showed us the fine art created by his computer artist friends. Our enthusiasm has grown to the extent that we are convinced of the commercial and aesthetic value of staying involved. Our reaction to a summer with this new art form is that we will definitely do it again. □

"Contained Contours I," a plotter graphic by Colette and Charles Bangert.

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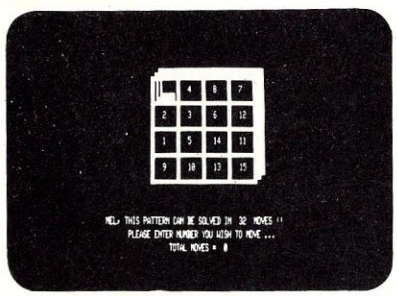

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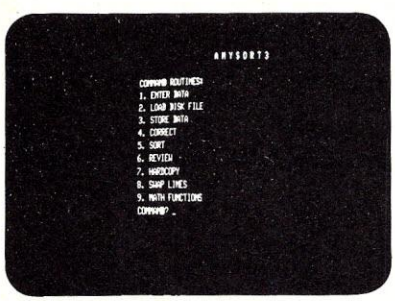

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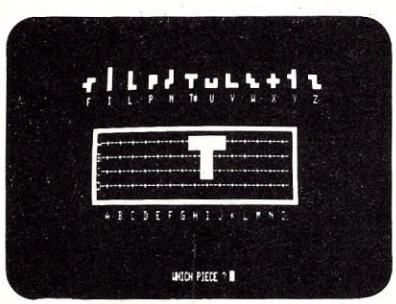

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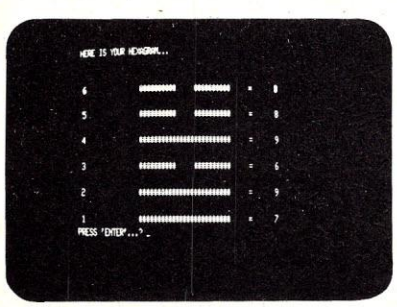

TRS-80 TIELINE

TRS-80 TIELINE is an extended smart terminal program. Functions supported with this package are the ability to send and receive BASIC data and programs. A fully supported set of timeshare ASCII control keys are software selectable. 'ESC' and a 'BREAK' key function do not require any handware modifications. Smart functions make it possible to jump from mode to mode with communication prior to program transmission or reception. Half and full duplex modes as well as line feed transmission or suppression, baud rate, parity, word length, stop bits are software selectable and can be changed while running. A printer can be connected for hard copy of communications as well as LLIST at baud rates that include 134.5 baud for certain serial printers. A special host or source mode allows other computers to use the TRS-80 TIELINE as a timeshare style computer. Programs can be run as well as disk files loaded, saved or transmitted by control from the distant computer. Character echo-back is supported. Host overide of forbidden commands is possible. An additional feature allows testing of the TRS-80/RS232 hardware. The program is available for DOS 2.0 - 2.2 machines with 32K memory, RS232 board and modem. Additionally, the package includes a free copy of 'THE TRS-80 DATA COMMUNICATION HANDBOOK' by Stephen Gibson. The handbook is a compilation of terms and in depth explanations of data communication from the standpoint of the user, the hardware, and the phone company. Various phone line services are detailed. Baud rates, bits and codes are explained at hobbyist level. How a Bell 103 modem works and how to connect it is covered with emphasis on originate and answer frequencies, duplex, half-duplex and RS232 conventions. The EIA standards are given with ASCII control character set information.

TIELINE	$24.95
TRS-80 DATACOMM HANDBOOK	$ 5.95

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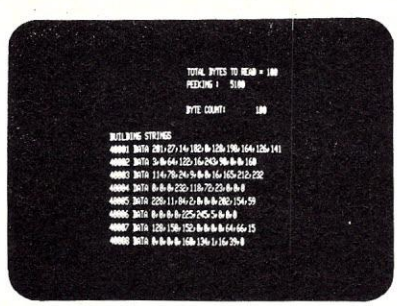

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1 = SMART TERMINAL MODE
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3 = RECEIVE DATA-PROGRAMS
4 = DUMP BUFFER TO BASIC
5 = DISPLAY BUFFER CONTENTS
6 = LPRINT BUFFER CONTENTS
7 = HOST COMPUTER
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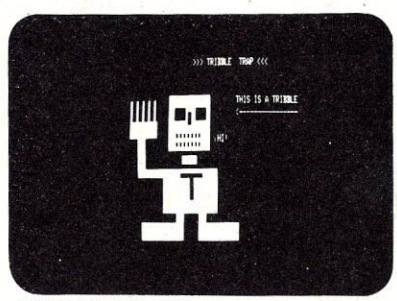

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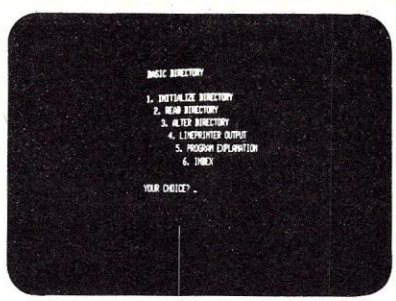

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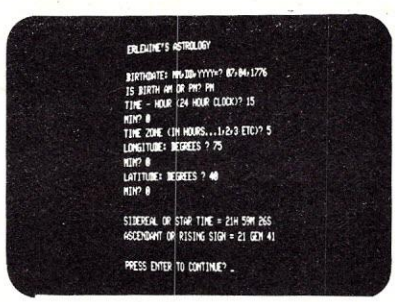
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TIME - HOUR (24 HOUR CLOCK)? 15
MIN? 0
TIME ZONE (IN HOURS...1=1 2=3 ETC)? 5
LONGITUDE: DEGREES ? 75
MIN? 0
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If you like PILOT, you're going to love MUMPS!

A Touch of Mumps

Joan Zimmerman

MUMPS is affecting a lot of people these days. No, I don't mean the disease. I mean an easy and enjoyable programming language. The MUMPS language is used mostly for dialogues between the computer and user during which the computer displays data to the user and collects data from him. Dialogues can capitalize upon MUMPS' strengths in checking entered data for format, length, numerical size and so on. Language features of MUMPS can check the users' entries immediately and request a correction when an error is found, thereby improving the quality of the stored data.

The medical flavor of the name "MUMPS" is due to the language's origin in the medical environment. MUMPS began in 1965 at the Laboratory of Computer Science of the Massachusetts General Hospital, Boston. It was created to speed the development of medical applications for clinical laboratories, medical records and so on. Its merits were soon being applied to more personal applications such as games, letter writing and other composition tasks, check-book balancing, and teaching one's children (and/or friends) to spell and do mathematics.

Implementations of MUMPS are in progress for the IMSAI 8080 (running under CP/M) by Dr. Richard Walters (at the University of California, Davis), for the Z-80 by Richard Zapolin (at the MITRE Corporation, Bedford), and for the Motorola M-6800 by Dr. E. Strasbourger (at the Technion, Israel). There are plans for the micro-Nova, the LSI-11 and others. Many MUMPS implementations have been made for mini-computers, particularly Digital Equipment Corporation's PDP-11 and PDP-15, Data General's Nova and Eclipse, Prime's Prime-300, Philip's P800 and Artronix's PC-12 and Modulex.

MUMPS is standardized. Standard MUMPS was developed by the MUMPS Development Committee (MDC) led by Ted O'Neill, Peter Ericson, and Jack Bowie. It was recently accepted by the American National Standards Institute (ANSI). There is an active users' group, the MUMPS Users' Group (MUG), with a developing application library and a quarterly newsletter. MUG publishes documents on MUMPS programming and the MDC has published a series of monographs describing MUMPS and how to implement it.

Joan Zimmerman, Tandem Computers, 19333 Valleo Parkway, Cupertino, CA 95014.

Two Examples

In view of the growing use of MUMPS, its acceptance by ANSI and the entry of MUMPS into the personal computing world, the following introduction to MUMPS is presented. It is illustrated by two examples of MUMPS code. First, a complete MUMPS routine for estimating the value of your exercise is shown in Figure 1. Interaction by a user with the routine is shown in Figure 2. As you can see, you are asked how much you have run, swum and cycled. Based upon your replies, the program calculates exercise points for the day(s) you indicated. The code for performing the calculation was written by me. It is based upon the "Point System" given by Kenneth H. Cooper, M.D., in his book *Aerobics*, published by Bantam Books, Inc. in 1968. (The revised and expanded point scheme given by Dr. Cooper in his 1970 book *The New Aerobics* is slightly more complex than the earlier scheme used for Figure 1.)

The second example of code, shown in Figure 3, is part of a larger program that teaches people interactively how to program in Standard MUMPS. A sample interaction with a student is shown in Figure 4. The teaching program displays text, asks each question, and evaluates each student's answer. If the answer is correct, the teaching program asks a new question; if it is incorrect, the teaching program gives a longer and simpler explanation, and perhaps asks a less complex question or two before returning to ask again the question that the student couldn't answer. The MUMPS code that directs the teaching program was developed by Chris Brigham and me. The explanatory material and questions to teach MUMPS programming were developed by me, with help from Bob Stimac.

The Components Of Mumps

The major components of MUMPS, as for most other high-level languages, are:

- —Data to be manipulated.
- —Commands. These define the types of action to be taken, such as the assignment of a value to a variable (by means of the SET command) or the display of text (by using the WRITE command).
- —Operators. These designate manipulations of the data. They include the greater-than operator (">") to find if one number is larger than another, and the pattern-match operator ("?") that is available for checking the format of entered data.
- —Functions. These provide a simple and compact notation for describing diverse often complex manipulations that can be performed on data. They include $DATA for determining whether or not a datum is defined, and $PIECE for pulling one set of characters out of another.

There is only one type of data value in MUMPS: a string of up to 255 characters. A value is often represented as text surrounded by quotation marks, such as:

"MUMPS: IT'S CATCHING BUT IT DOESN'T HURT"

A special case of a MUMPS string is a number, such as 1066. Numbers may be quite large, up to 10^{25}, with nine digits of precision.

Each MUMPS command is followed by one or more arguments that further specify what the command does. An argument is composed of data,

operators and functions. Let us look at the examples to see MUMPS in action.

Aerobics Example

Aerobics is exercise that lasts long enough to cause a considerable increase in your pulse rate and your oxygen consumption. Examples are walking or running, swimming and bicycling. In practice aerobic exercise should last for at least 12 minutes. The further you run, swim, or bicycle, and the faster your rate of exercise, the more aerobic exercise you give your body. Dr. Cooper's aerobic point score reflects the amount of aerobic exercise. For example, if you run 1 mile in 9 minutes you get 4 points, but if you can do it in 7 minutes you get 5 points. However, if it takes you 20 minutes or more, you have taken too long for the exercise to have an aerobic effect and you score no points. As you increase your distance, you get more points, even if you are quite slow. A reasonable goal for a week is a total of 30 points. This could be achieved by running 1.5 miles in about 14 minutes on 5 days out of the week, or in many other ways. For more facts and ideas, see Dr. Cooper's books. (Sedentary workers such as computer programmers, by the way, should take particular care to obtain enough aerobic exercise.) And remember that the Aerobics Institute Research Society charges $24 a year for keeping an automated monthly record for exercisers of their achievements: you could provide such a service on your microcomputer.

General Code Structure

The MUMPS code for calculating your aerobics points is shown in Figure 1. It illustrates all the major MUMPS features. First of all, the code is a sequence of lines. Any line may have a label or name, shown in the left-hand column. In practice, only a few of the lines are labeled so as not to clutter up the code. A labeled line usually introduces a segment of code to which execution will branch from elsewhere, or code that will be invoked as a subroutine. This selective labeling helps the programmer to partition his code into logical segments. Also, the programmer's choice of mnemonic line labels (such as RUN, SWIM and BIKE in Figure 1) can remind him of each segment's purpose. This is particularly helpful if he wants to modify the code some time after he wrote it, when he will have forgotten almost everything about how it works.

Code may be further documented by means of comments, indicated in MUMPS by an initial semicolon. The first line, ZEX, in Figure 1 is a comment line. Actually, it adheres to the convention used by many MUMPS programmers of indicating in a routine's first line who wrote the routine, when and for what purpose.

```
ZEX    ;ZIM;4 OCT 77;COOPER'S AEROBICS POINTS SYSTEM (1970)
       KILL  SET SUM=0,DAY=$PIECE($HOROLOG,",",1)

       READ !!,"IS YOUR EXERCISE DATA FOR TODAY? (YES OR NO) ",X,!!
       IF X'?1"Y".E READ "HOW MANY DAYS AGO? ",X,!! SET DAY=DAY-X
       IF $DATA(^ZEX(DAY)) WRITE "CHANGE FROM ",^(DAY)," POINTS? " READ X,! IF X'
["Y" QUIT
RUN    READ "HOW MANY MILES DID YOU RUN? ",MILES,! IF 'MILES GOTO SWIM
       IF MILES>100 WRITE "IMPOSSIBLE",! GOTO RUN
       IF MILES>2 WRITE "    VERY GOOD",!
       READ "HOW MANY MINUTES DID THAT TAKE? ",MINS,!
       IF 'MINS DO ZERO GOTO RUN
       SET T=MINS/MILES IF T<8 WRITE "THAT'S FAST!",!
       IF MILES<2,T>19.99 SET POINTS=0 GOTO ERUN
       SET POINTS=$SELECT(T<6.5:6,T<8:5,T<10:4,T<12:3,T<14.5:2,T<20:1,1:.5)*MILES

ERUN   DO SET GOTO RUN
SWIM   READ "HOW MANY YARDS DID YOU SWIM? ",YARDS,! IF 'YARDS GOTO BIKE
       IF YARDS>500 WRITE "WELL DONE",!
       READ "HOW MANY MINUTES DID YOU TAKE? ",MINS,! IF 'MINS DO ZERO GOTO SWIM
       SET T=100*MINS/YARDS
       IF YARDS<300,T>3.3 SET POINTS=0 GOTO ESWIM
       SET POINTS=$SELECT(T<1.667:1.25,T<2.5:.85,T<3.333:.625,1:.2)*YARDS/100
       IF POINTS<1 SET POINTS=0
ESWIM  DO SET GOTO SWIM
BIKE   READ "HOW MANY MILES DID YOU CYCLE? ",MILES,! IF 'MILES GOTO END
       IF MILES>6 WRITE "GOOD",!
       READ "HOW MANY MINUTES DID YOU TAKE? ",MINS,! IF 'MINS DO ZERO GOTO BIKE
       SET T=MINS/MILES
       IF MILES<5,T>5.99 SET POINTS=0 GOTO BIKE
       SET POINTS=$SELECT(T<3:1.5,T<4:1,T<6:.5,1:.22)*MILES
EBIKE  DO SET GOTO BIKE
END    WRITE:DAY=+$HOROLOG "TODAY'S " WRITE "POINTS = ",SUM,!
       SET ^ZEX(DAY)=SUM WRITE "GOODBYE",! KILL QUIT
SET    SET SUM=SUM+POINTS
       WRITE "YOU JUST ADDED ",POINTS," POINT" IF POINTS'=1 WRITE "S"
       WRITE "AND YOUR TOTAL IS ",SUM,!,"ENTER MORE",!! QUIT
ZERO   WRITE "YOU CAN'T DO THINGS IN NO TIME",!! QUIT
%      WRITE "ZEX" ZSTORE ZEX 0
```

1. MUMPS routine for estimating in "aerobic points" the value of your running, walking, swimming, and cycling exercise. (Line ZEX+4 is so long that the code ["Y" QUIT from the end of that line is printed on a new line.

Variables

Variables are very important in all computer languages. A variable is an entity whose value may change. A variable name usually consists of up to eight alphabetic characters. Each variable may have a value of a variable-length string of characters, including the special case of a number. There are three types of variable:

1. Local variables. Each local variable is stored in the core of your computer and is unique to a user. The value of a local variable may be changed only by that user. Examples are SUM and DAY in line ZEX+1 (the line below ZEX).
2. Global variables. Each global variable is stored on a disc or other long-term storage medium. It may have its value inspected and changed by any user signed on to the data base. A global name is designated by a leading circumflex symbol ("^"). An example is ^ ZEX in line ZEX+4. In practice, global variables take subscripts in parentheses after the global name, so that many values can be stored in different locations under the same overall global name. In our case we use the subscript DAY, and we store at different locations of ^ ZEX the different numbers of aerobics points earned for the different values of DAY for which data are entered.
3. Special variables. The value of a special variable is assigned by the MUMPS system and cannot be changed directly by a user. The name of a special variable is designated by a leading dollar ("$") symbol. An example is $HOROLOG in line ZEX+1.

Commands

The second line in Figure 1 shows two common MUMPS commands. That line begins with the

KILL

command, which removes all existing local variables so that the user's work space does not become cluttered with unnecessary data. On the same line (yes, you may put many commands on one line) is the

SET

command. This command is followed by "SUM", which is the name of a local variable to which the value of zero is assigned by:

SET SUM=0

Another example of the SET command appears in the line labeled SET (four lines from the end) and contains the code:

SET SUM=SUM+POINTS

Here the value of the variable SUM is incremented by the value of the variable POINTS, thereby gradually building up the value of SUM from zero to the total number of exercise points attained for the day.

Line SET+1 (the line below SET)

Mumps, con't...

shows another common MUMPS command:

WRITE

This command allows you to display text and the values of variables. In line SET+1, the computer is instructed to tell the user:

YOU JUST ADDED

and then show the value of the variable POINTS, which will be a number of zero or (hopefully!) more. The computer adds the word "POINT" after the number. At the end of this same line (SET+1) is the

IF

command. It determines whether the variable POINTS has the value 1 by means of the code

IF POINTS'=1

This means that if the value of the variable POINTS is not (not is signified by "'") equal to ("=") 1 then an "S" is written to make the displayed "POINT" plural: "POINTS".

Another frequently used command is:

READ

Examples start lines RUN, SWIM, and BIKE. The READ command can cause string constants like "HOW MANY MILES DID YOU RUN?" to be displayed as does the WRITE command. The difference between the two commands is how they handle variables. The instruction:

```
D ^ZEX


IS YOUR EXERCISE DATA FOR TODAY? (YES OR NO) YES

HOW MANY MILES DID YOU RUN? 3
  VERY GOOD
HOW MANY MINUTES DID THAT TAKE? 27
YOU JUST ADDED 12 POINTS AND YOUR TOTAL IS 12
ENTER MORE

HOW MANY MILES DID YOU RUN?
HOW MANY YARDS DID YOU SWIM?
HOW MANY MILES DID YOU CYCLE? 3
HOW MANY MINUTES DID YOU TAKE? 15
YOU JUST ADDED 1.5 POINTS AND YOU TOTAL IS 13.5
ENTER MORE

HOW MANY MILES DID YOU CYCLE? 3
HOW MANY MINUTES DID YOU TAKE? 20
YOU JUST ADDED 0 POINTS AND YOUR TOTAL IS 13.5
ENTER MOVRE

HOW MANY MILES DID YOU CYCLE?
TODAY'S POINTS = 13.5
GOODBYE

>

 D ^ZEX


IS YOUR EXERCISE DATA FOR TODAY? (YES OR NO) NO

HOW MANY DAYS AGO? 2

HOW MANY MILES DID YOU RUN? 2
HOW MANY MINUTES DID THAT TAKE? 18
YOU JUST ADDED 8 POINTS AND YOUR TOTAL IS 8
ENTER MORE

HOW MANY MILES DID YOU RUN?
HOW MANY YARDS DID YOU SWIM?
HOW MANY MILES DID YOU CYCLE?3
HOW MANY MINUTES DID YOU TAKE? 16
YOU JUST ADDED 1.5 POINTS AND YOUR TOTAL IS 9.5
ENTER MORE

HOW MANY MILES DID YOU CYCLE?
POINTS = 9.5
GOODBYE
```

2. Interaction by a user with the "aerobics" routine shown in Figure 1.

causes the computer to display the value of the variable X. On the other hand, the instruction

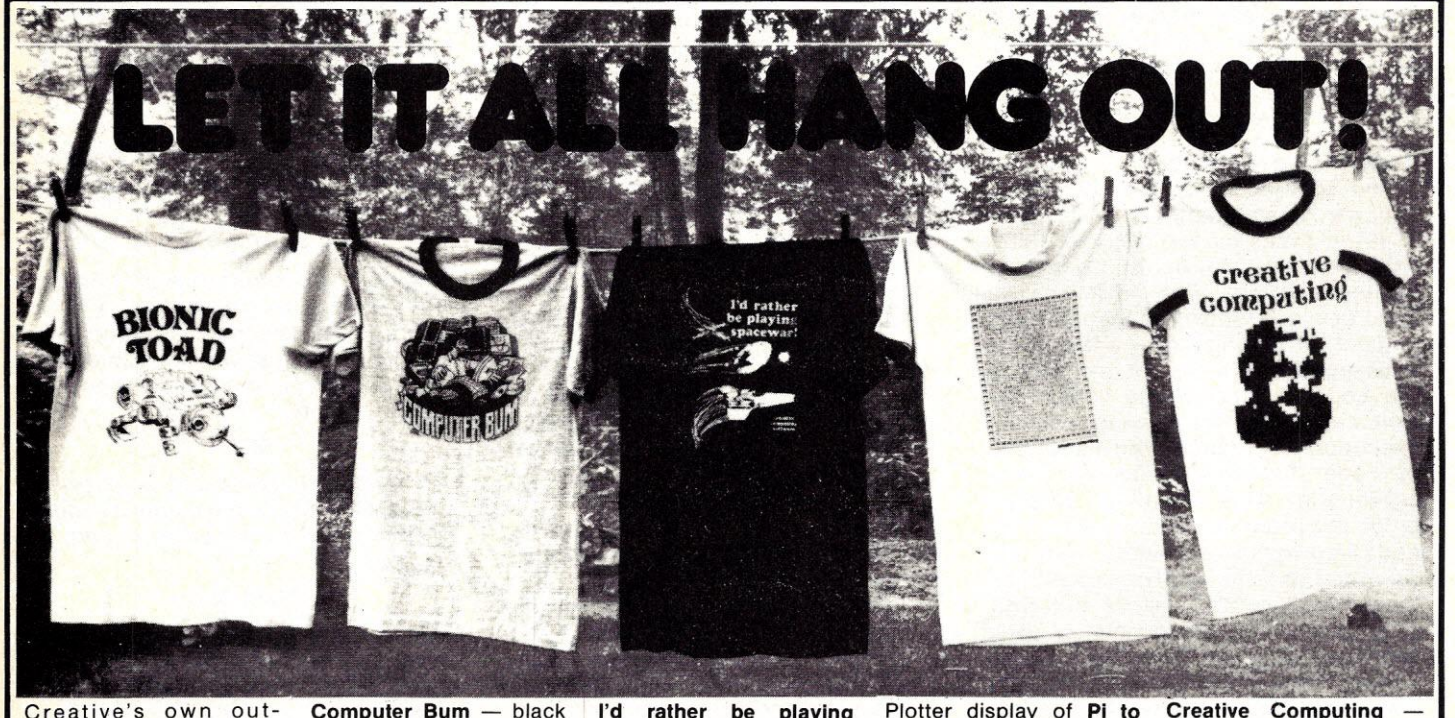
READ X

causes the computer to wait for the user to type in a value to be assigned to the variable X. So, in line RUN, the READ command prompts the user by asking him how many miles he has run and waits for him to enter a value for the variable MILES. (The exclamation mark ("!") after the variable name MILES is a formatting operator. It causes a "carriage-return/line-feed" so that a new line is started for subsequent text.)

The last three commands discussed here are DO, GOTO and QUIT. DO invokes a subroutine. For example, in line ERUN:

DO SET

causes execution to branch from line ERUN to line SET and to continue through lines SET+1 and SET+2, until finally the QUIT command at the end of line SET+2 is encountered. QUIT signifies the end of the subroutine, and



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execution returns to line ERUN at the position after:

DO SET

where we see:

GOTO RUN

Accordingly the computer next executes a GOTO command causing transfer of execution to line RUN. The difference between the DO and the GOTO command is that the DO command specifies a temporary transfer of execution that will return to the instruction after the invoking DO command once the subroutine is completed. (That completion is signified by a QUIT command.) On the other hand, the GOTO command specifies a permanent transfer of execution.

Operators

MUMPS contains the usual arithmetic operators of addition ("+"), as in line SET:

SET SUM=SUM+POINTS

subtraction ("-"), as in line ZEX+3:

SET DAY=DAY-X

and multiplication ("*") and division ("/"), as in line SWIM+3:

SET T=100*MINS/YARDS

The language also contains the "\" operator, which causes division but with the result truncated to a whole (nonfractional number), and the "#" operator, which is the modulo operator and yields the remainder of a division.

Three arithmetic "relational" operators are available. First is the equals operator ("="), as in line SET+1:

IF POINTS'=1

(The equals operator is qualified by the negation operator ("'") so that we are actually determining whether the value of POINTS does *not* equal one.) Next is the greater-than (">") operator, as in line RUN+1:

IF MILES>100

Similar but opposite in effect is the less-than ("<") operator, as in line RUN+6:

IF MILES<2

The above operators all manipulate numbers. Other operators manipulate strings, and two such operators appear in Figure 1. The simpler one is the contains ("[") operator, which is useful for determining whether one string contains another, as in line ZEX+4:

IF X'["Y" QUIT

```
ZOST  ;CRB,JZ;27 JUN 77;PART OF "TAKE QUESTIONNAIRE" FOR CREATIVE COMPUTING
AN    WRITE !,$PIECE("^NUMBER #^ANSWER:^YES/NO?","^",TY),"  "
      SET RTS=$PIECE($HOROLOG,",",2) READ RN:300,!
      SET RT=$PIECE($HOROLOG,",",2)-RTS
      ELSE WRITE "I STOPPED BECAUSE I THOUGHT YOU HAD GONE AWAY",! SET RN="END"
 QUIT
      IF RN="?" WRITE "ENTER ",$PIECE("^A NUMBER^FREE TEXT^YES OR NO","^",TY),"
OR ""END""" GOTO AN
      IF $LENGTH(RN)>95 WRITE !,"* BRIEFER *" GOTO AN
      IF $EXTRACT(RN,1)'="!" QUIT
      IF RLF'["C" WRITE !,"COMMENTS ARE NOT RECORDED" GOTO AN
      DO CM SET DAY=^QUA(CN,FR,0)
      WRITE !,"THANKS.  ENTER YOUR ANSWER NOW" QUIT
CM    WRITE !,"ENTER COMMENTS (END BY PRESSING ONLY THE 'ENTRY' KEY)"
      FOR A=Z:1 READ !,": ",X GOTO N:X="" DO:$LENGTH(X)>100 CLONG SET ^QUB(CN,ID
S,2000+A)=FR_") "_X
N     SET ^QUB(CN,IDS,2000)=A-1,Z=A QUIT
CLONG SET X=$PIECE(X,1,$FIND($EXTRACT(X,70,999)," ")-2)
      WRITE "REMEMBER TO PRESS ENTRY KEY AFTER EACH LINE. WE HAVE STORED:",!,X

QUIT
%     WRITE "ZOST" ZSTORE ZOST QUIT
```

3. Part of a MUMPS program that teaches people interactively how to program in Standard MUMPS. (Lines AN+3, AN+4, and CM+1 are so long that each is continued on a new line.)

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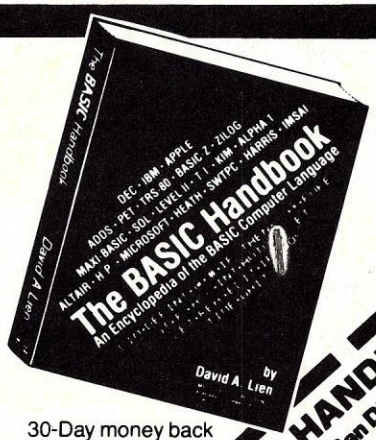

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The operator is qualified by the negation ("'") operator, so that this code reads: if the value of the variable X does not contain the character "Y" then stop.

Also illustrated is the pattern-match operator ("?"), which appears in line ZEX+3 as:

IF X'?1"Y".E

Again the operator is qualified by the negation operator. The code means that if the variable X does not have the pattern whose format is defined by the code:

1"Y".E

then do whatever comes next (i.e. find out how many days ago the exercise to be reported was done). The code following a pattern-match operator comprises a series of particular characters sought (in quotation marks) or the code for the types of character sought (such as A for any alphabetics, N for numerics, or E for anything); each pattern code or set of characters in quotes is preceded by a digit denoting the number of instances looked for. The code in our example means that we are looking for a format of one letter Y (1"Y") followed by any number (represented by ".") of characters of any kind ("E").

Other string operators are the string-equals ("=") operator, which looks for equality of strings, the follows ("]") operator mostly used for determining whether one string follows another alphabetically, the catenation ("_") operator used for joining two strings together to form one, and the indirection ("@") operator, which allows data values to be executed as MUMPS code.

Functions

Standard MUMPS contains 13 functions. The example in Figure 1 shows three of them:

$PIECE

in line ZEX+1

$DATA

in line ZEX+4, and

$SELECT

in lines RUN+7, SWIM+5, and BIKE+5.

Consider $PIECE. It appears in line ZEX+1 as:

SET DAY=$PIECE($HOROLOG,",",1)

$PIECE manipulates the items that follow it between parentheses. The first item in the example is $HOROLOG, a system variable whose value is a string of digits signifying the day followed by a comma and then the number of seconds that have elapsed since midnight. After $HOROLOG comes a comma and a string contained in quotation marks:

```
D ^QUE

HI THERE!
** WARNING **
THE TEACHING PROGRAM WILL NOT BE AVAILABLE AFTER FRIDAY 21 APRIL.
HOPE YOU CAN FINISH ALL YOU NEED TO DO BY THEN.
IF NOT, SEE JOAN.


ENTER YOUR LAST NAME: ZIMMERMAN
ENTER YOUR FIRST NAME: JOAN

DO YOU NEED A LIST OF LESSONS? YES
LESSON 1.  OUTLINE OF THE STANDARD MUMPS COURSE
LESSON 2.  BACKROUND ON MUMPS
LESSON 3.  CONCEPTS
LESSON 4.  COMMANDS
LESSON 5.  FUNCTIONS
LESSON 6.  OPERATORS
LESSON 7.  FURTHER COMMANDS
LESSON 11. DIRECT MODE COMMANDS (DEC, PDP-11)
LESSON 12. NOT WRITTEN (TO BE PDP-10/RRC DIRECT MODE)
LESSON 13. NOT WRITTEN (TO BE B6700/DAVIS DIRECT M.)
LESSON 14. NOT WRITTEN (TO BE S360/NLM DIRECT MODE)
LESSON 15. NOT WRITTEN (TO BE PRIME DIRECT MODE)
LESSON 21. GLOBALS
LESSON 22. INPUT/OUTPUT AND SPECIAL VARIABLES
LESSON 23. CONDITIONAL COMMANDS: INDIRECTION
LESSON 98. AUTHOR'S AIDS
LESSON 99. GUIDANCE ON QUESTIONNAIRE USE

LESSON # 4    COMMANDS

   LET ME BEGIN WITH SOME MUMPS CODE. HERE IT IS:"

WRITE "HELLO, WHO ARE YOU? " READ X WRITE "HELLO, ",X

THE FIRST WORD ON THAT LINE OF CODE IS THE WRITE COMMAND.
JUST TO MAKE SURE YOU KNOW WHAT A COMMAND IS, PLEASE SELECT
AN ANSWER FROM THE FOLLOWING:
1. A COMMAND IS AN INSTRUCTION GIVEN TO THE COMPUTER
2. I AM NOT SURE; PLEASE REFRESH MY MEMORY
NUMBER # 2


* THE WORD "COMMAND" IS USED IN MUMPS TO DENOTE A WORD OF INSTRUCTION
TO THE COMPUTER.  WHEN YOU WANT THE COMPUTER TO DO SOMETHING FOR YOU,
YOU GIVE IT THE APPROPRIATE COMMAND. FOR EXAMPLE IF YOU WANT THE
COMPUTER TO WRITE SOMETHING FOR YOU, YOU USE THE "WRITE" COMMAND.
IS THAT CLEAR?
YES/NO? YES


GOOD

   THE WRITE COMMAND LETS YOU DISPLAY STRINGS OF CHARACTERS.
WHAT IS THE RESULT OF THE FOLLOWING MUMPS CODE:
WRITE "HELLO"
1. THE COMPUTER WRITES HELLO, RIGHT IN FRONT OF YOUR EYES.
2. THE COMPUTER IGNORES YOU.
3. THE COMPUTER SAYS HELLO OUT LOUD.
4. I DON'T KNOW.
NUMBER # 1
```

4. Sample interaction between a student and the Standard MUMPS teaching program, part of which was shown in Figure 3.

","

That string specifies the characters (in this case a single comma) by which the first item in the parentheses ($HOROLOG) is to be broken apart. Finally there is another comma and the number:

1

before the closing parenthesis, showing that the group of characters before the first comma in $HOROLOG is to be taken as the desired PIECE. The resulting number signifies the day and is assigned to the variable DAY.

The second function is $DATA. This appears in line ZEX+4 as:

IF $DATA(^ZEX(DAY))

$DATA determines whether the variable following it in parentheses already exists. The variable in parentheses is the global variable ^ZEX(DAY). It will only be defined if data have already been entered for the date represented by the present value of DAY. That value is either today's date or the number of days previously specified by the user in line ZEX+3.

The third function is $SELECT. This is a powerful function. It is a little complex, but after you have mastered this one, you will find the remaining MUMPS functions very easy. Consider what we want to do with $SELECT. Basically, we want to determine how many aerobic points we have earned for our exercise. Look at running. We calculate in line RUN+5 a value for the variable T that is equal to the number of minutes for which we have run divided by the number of miles we ran. This is calculated by the code:

SET T=MINS/MILES

In line RUN+6 we weed out the guys that run under 2 miles and take more than 20 minutes per mile, by assigning them zero points and branching to the line ERUN. For the more successful exercisers, the $SELECT function in line RUN+7 assigns points depending upon the number of minutes taken per mile. (The numbers of points come from the tables in Dr. Cooper's book.) If you took under 6.5 minutes per mile, you are a really speedy guy and you get 6 points for each mile you ran; if you

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took 6.5 minutes or more but under 8 minutes you get 5 points per mile run. And so on until if you took 20 minutes or more per mile (but ran over 2 miles and so were not rejected in line RUN+6) you get a meager 0.5 points per mile. You could express this as a series of IF commands taking seven lines:

```
IF T<6.5 SET POINTS=6*MILES
  GOTO ERUN
IF T<8 SET POINTS =5*MILES GOTO
  ERUN
IF T<10 SET POINTS =4*MILES
  GOTO ERUN
IF T<12 SET POINTS=3*MILES GOTO
  ERUN
IF T<14.5 SET POINTS=2*MILES
  GOTO ERUN
IF T<20 SET POINTS=MILES GOTO
  ERUN
SET POINTS=MILES/2
```

But all this can be done in a single line (RUN+7) by using one command and the $SELECT function. The $SELECT function contains in its parentheses a sequence of pairs. The first item in each pair is a "truth-valued expression" (such as T<6.5), which is evaluated to determine if it is true or false. This is followed by a colon and the second member of the pair (such as 6), denoting the value to be assigned to the $SELECT function if the truth-valued expression is true. Thus the first pair of items in the parentheses is:

```
T<6.5:6
```

meaning that if T is less than 6.5 then $SELECT is to have the value of 6. The next pair, separated from the first pair by a comma, is:

```
T<8:5
```

Now, if T is not less than 6.5 (causing T<6.5 to be false) the truth-value T<8 is evaluated and if T is less than 8 then $SELECT has the value 5. The function built up thus far with these two pairs is:

```
$SELECT(T<6.5:6,T<8:5
```

The function is completed as shown in line RUN+7. Note that the last pair of items is:

```
1:.5
```

The truth-valued expression here is simply 1, which by convention means true. Accordingly, if evaluation progresses this far, $SELECT is forced to have the value 0.5, thereby ensuring that a value for $SELECT will always be defined no matter what the value of T.

Discussion

From the information given you should be able to see how the rest of the code in Figure 1 works. Lines SWIM to ESWIM collect data on how far you swam and how long you took. In line SWIM+3, the mean time taken per 100 yards swam is calculated as the value of T, and the result is used in line SWIM+5's $SELECT function to determine the number of points earned. When no more swimming data are to be entered, execution moves to line BIKE, where data on cycling are collected. Finally, lines END and END+1 are executed in which the total points scored are noted and the result is stored safely away in global ^ZEX (DAY). With what you have learned you, could now write a MUMPS routine that scans through the data stored in ^ZEX for the last 7 days and that tells you whether or not you achieved at least 30 points during the week.

Teaching Program Example

There are many aspects to the teaching program shown in Fig. 3 and 4, including the authoring and editing of the text and questions, the student's use of the teaching program, and the subsequent inspection by a supervisor of how correctly and quickly the student has passed through the course work. The example shown in Figure 3 is part of the code that prompts a student to answer a displayed question, as indicated in the documentation line, ZQST. Questions can be of four types:

1. No response required.
2. Multiple-choice, for which a number is to be entered that

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corresponds to one of the displayed alternate answers.
3. Free text, where a student may enter an answer with no constraints.
4. Yes/no, where a student is to enter either yes or no.

The variable TY has the value of 1, 2, 3, or 4, depending upon which type of question is being asked. If a response is required, the $PIECE function in line AN causes the appropriate prompt to be displayed. (Note that here the string used as the divider is "^" instead of the "," used in line ZEX of the aerobics example.)

Line AN+1 sets variables RTS equal to the value of the present time by taking the piece of $HOROLOG after the comma. (We used the first part of this system variable in the aerobics example to determine the date.) This is done in order to measure how long the student takes to answer the question, and read his answer into variable RN by:

READ RN:300,!

The ":300" after RN is called a "time out." It places a limit upon the number of seconds that the computer will wait for a response: if the student makes no response within 5 minutes, the system proceeds to the next code. The "!" is the carriage-return/line-feed format operator once again. In the next line, we calculate the number of seconds taken to respond to the question by subtracting RTS from the present time.

Line AN+3 introduces a new command:

ELSE

which may thought of as the opposite of IF. ELSE has no argument and therefore has two spaces after it. It makes use of a system variable called $TEST. The value of $TEST can be changed indirectly by various causes. Of relevance to our example is that the value of $TEST depends on whether the value of RN is entered within 5 minutes (in which case $TEST is 1) or whether it is not entered in time ($TEST becomes 0). When $TEST has the value 0, the code following the ELSE command is executed. Thus, if the answer was not entered in time, the computer says:

I STOPPED BECAUSE I THOUGHT YOU HAD GONE AWAY

and sets the value of RN equal to "END" and stops.

Usually an answer is entered quickly enough and so execution moves to line AN+4, where the value of RN is checked. If it is equal to a question mark ("?"), indicating that the student is not sure what to do, a brief explanation is given of the desired type of answer before the system branches back to line AN. RN is checked in the next line (AN+5) for length by means of the

$LENGTH

function, which yields the number of characters in the value of the variable in the function's parentheses. If the response is over 95 characters long, we request a briefer response. Our final check on the value of RN is in line AN+6 and makes use of the

$EXTRACT

function, which pulls out from a string a group of characters. The example:

$EXTRACT(RN,1)

means the first character of the answer, RN. If the first character is not an exclamation mark ("!") we stop this subroutine. However, a leading exclamation mark means that the student wants to enter a comment; if the variable RLF contains a "C" denoting that the author wants comments they are entered using lines AN+8 and AN+9, and the comment subroutine starting at line CM. The reader may figure out how this is done with the following hints:

1. The FOR command with the argument "A=Z:1" means that A is to be set equal to the value of the variable Z (a counter that holds the total number of comment lines entered by the student while taking a lesson) and the rest of the line is to be executed; A is then to be incremented by 1 and the line again executed; and so on. This stops only when no line of comment is entered, so that X has the value "", at which point the code "GOTO N" is executed.
2. ^QUB(CN,IDS,2000+A) specifies the part of the global variable ^QUB where this particular line of comments is to be stored. CN is a number that specifies the chapter being learned by the student. IDS is a unique number designating the student. CN and IDS are used as subscripts of ^ QUB, as is 2000+A.
3. The comment is recorded as:

   FR_")"_X

   where FR is the particular frame or question number for which X is a line of comment.

Resources For Further MUMPS Information

Information on MUMPS and the MUMPS Users' Group may be obtained from Mr. Richard E. Zapolin, MUG Executive Director, The MITRE Corporation, P.O. Box 208, Bedford, MA 01730. Among the documents you might like to purchase are:

—Standard MUMPS Pocket Guide, a concise summary of all the features of the MUMPS language. $1 per copy.
—Book of MUMPS, a review of the MUMPS language and its applications, including a list of the 15 machines upon which MUMPS is implemented, and the sources of the implementations. $2 per copy.
—MUMPS Programmer's Reference Manual (developed by the MDC), a detailed reference work on the language. $5 per copy.
—Advanced MUMPS Techniques, a text on all aspects of writing powerful and effective MUMPS code. $9 per copy.

Information on the MUMPS Development Committee and further development of the MUMPS language may be obtained from Dr. Richard F. Walters, MDC Chairman, University of California at Davis, Medical Learning Resources, Davis, CA 95616. □

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Digital Equipment Corporation's *Introduction to the MUMPS-11 Language* and *MUMPS-11 Language Reference Manual*. These documents may be obtained from your local Digital Equipment Corporation office.

MUMPS Development Committee documents on implementing the MUMPS language may be obtained through the MUMPS Development Committee Chairman, Dr. Richard F. Walters, University of California at Davis, Medical Learning Resources, Davis, CA 95616.

MUMPS Users' Group documents may be obtained from the MUG Executive Director, Mr. Richard E. Zapolin, The MITRE Corporation, PO Box 208, Bedford, MA 01730.

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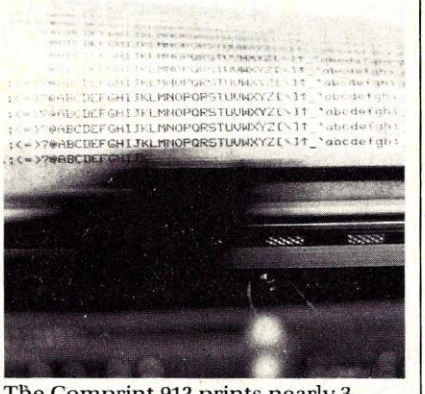

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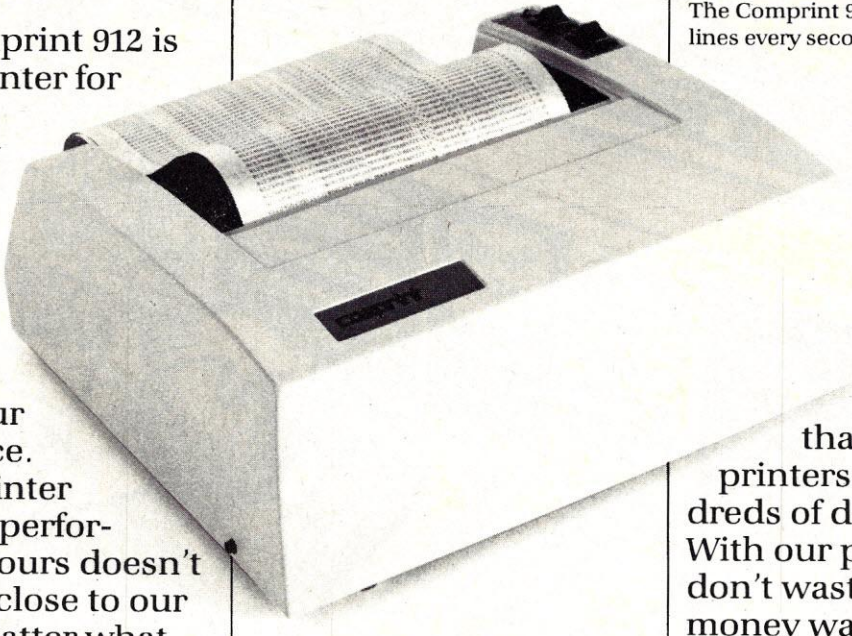

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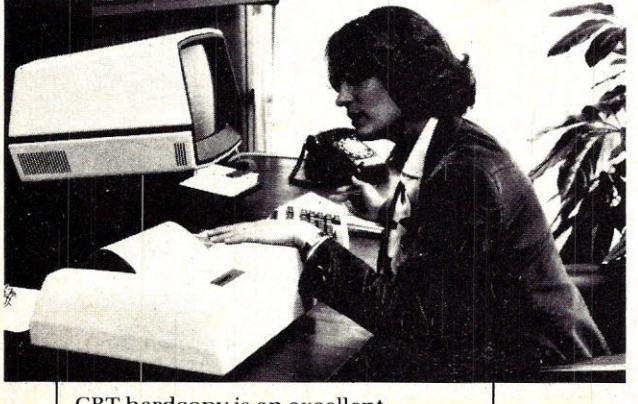

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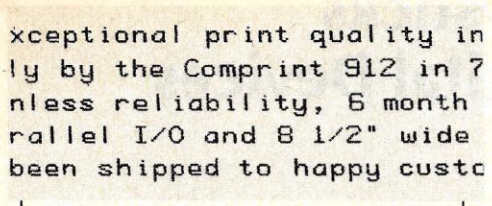
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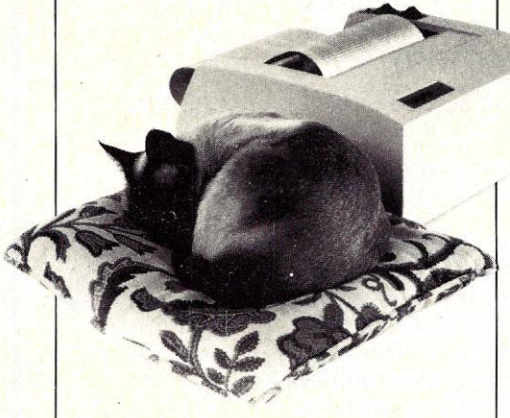

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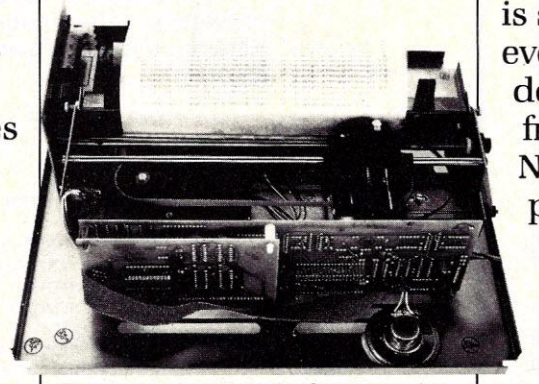

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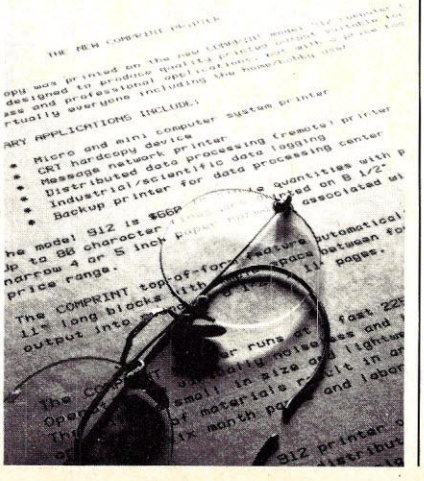

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Build Your Own Joysticks And Other Analog-To-Digital Devices

Gary Sabot

Most computer hobbyists would like their computer to be equipped with an Analog-To-Digital (A/D) converter. Such a converter allows a system to respond to input from joysticks and slide pots (perfect for games), serve as a digital voltmeter, along with other similar applications. Many hobbyists, however, have shied away from A/D converters because of their high cost.

This article will present an eight-channel A/D converter for which parts can be purchased for less than $10. Its abilities and uses are far more numerous than its simple design and low parts count imply.

Circuit Operation

The A/D converter (Figure 1) may be divided into two functional parts: a ramp generator and the two 339 quad comparators. In electronics, a ramp is a portion of a waveform that changes linearly with time. This particular ramp generator is composed of Q1, Q2 and their associated circuitry.

Q2 and R4 form an "electronic switch" that is controlled through software. Q1 and R1-3 form a constant current source. This source attempts to charge C1. At T0 (Figure 2) the electronic switch was closed and was acting as a short across C1. At T1 the computer "opened" the switch by grounding R4 through an output port. The constant current source then began to charge C1 at a linear rate, producing a ramp. At T2 the computer "closed" its switch by sending a logical "1" through a port and this ends the ramp. The relation between ramps and A/D conversion may be unclear at this point, but it will be explained later.

Each 339 IC contains four comparators. Each comparator has a + input, a -input and an output. If the voltage on the + input is greater than the voltage on the -input the output will be a logical "1." If the voltage on the -input is greater than the voltage on the + input the output will be a logical "0."

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Following is an 8080 version of the conversion software for the Northstar Horizon. It is as follows: (Assembled for 01H:

```
0000                    ;STORAGE FOR MASK AND RETURNED COUNT
0001    PUSH PSW
0002    PUSH H
0003    PUSH B
0004    MVI  H,00       ;LOAD HL WITH STORAGE LOCATION
0006    MVI  L,00
0008    MVI  B,00       ;CLEAR COUNTER
000A    XRA  A          ;CLEAR ACCUMULATOR
000B    OUT  00         ;START RAMP
000D    IN   00         ;CHECK STATUS
000F    ANA  M          ;MASK OUT
0010    JNZ  001A       ;EXIT WHEN BIT=1
0013    INR  B          ;INCREMENT COUNT
0014    MOV  A,B
0015    CPI  FF         ;IS COUNT OVER 255?
0017    JC   000D       ;NO, LOOP
001A    MVI  A,80H
001C    OUT  00         ;RESET RAMP
001E    MOV  M,B        ;SAVE COUNT
001F    POP  B
0020    POP  H
0021    POP  PSW
0022    RET
```

The following is a Northstar BASIC routine that will FILL the conversion software into memory:

```
1 FOR K=0 TO 34
2 READ I
3 FILL K,I
4 NEXT K
5 DATA 0,245,229,197,38,0,46,0,6,0,175,211,0,219,0,166,194,26
6 DATA 0,4,120,254,255,218,13,0,62,128,211,0,112,193,225,241,201
```

To use the A/D converter, after running the previous routine, you FILL location 0 with the appropriate bit mask. (1, 2, 4, 8, 16, 32, 64, or 128). You then CALL location 1. The value of the requested analog input will be in location 0. (Retrieve it with an EXAM statement).

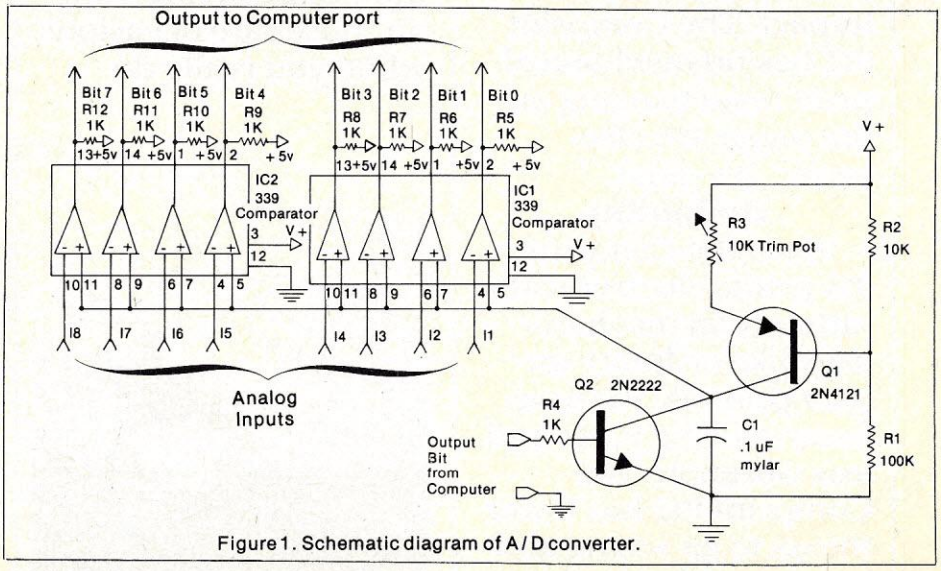


Figure 1. Schematic diagram of A/D converter.

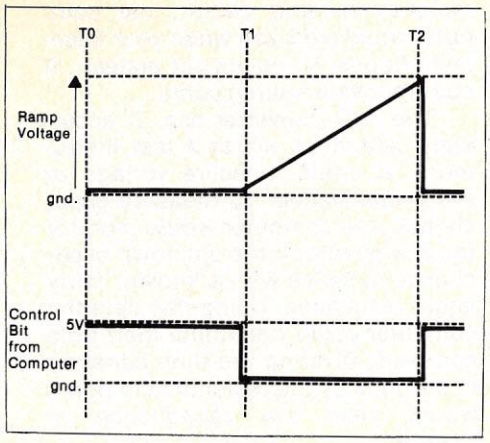


Figure 2. Timing diagram of control bit from computer and ramp from A/D converter.

To convert an analog signal to a digital signal, the analog signal is applied to the -input and the output from the ramp generator is fed into the + input. The computer, through software, records the time interval between the closure of the electronic switch and its sensing a logical "1" at the output of the appropriate comparator. The length of this interval is proportional to the magnitude of the analog voltage. If the analog voltage is 0, as soon as the ramp begins to increase, it will be greater than the voltage and the comparator will output a logical "1." The time interval would be quite short. If the analog voltage applied is 5V, however, the ramp would have to be increasing for some time before it becomes greater than the analog input voltage. The time interval, then, would be comparatively long.

In Figure 3, the reason the ramp terminates almost immediately after it surpasses the analog input is because the computer has "closed" its switch. That is, the computer had already recorded the time interval and it no longer required the remainder of the ramp. A consequence of this process is that, unless the software compensates (through delay loops), a lower voltage will take less time to convert into a digital value than a higher voltage.

Construction

As a result of the low parts count in the converter, almost any construction technique can be used, including perfboard, PC board and wire-wrap. Parts placement is not critical. (I used a solderless breadboard to construct the prototype). In any case, note that the pull-up resistors (R5-R12) will be connected to the host computer's 5V line, not V+.

Testing and Interfacing

If a triggered oscilloscope is available, follow the testing procedure detailed in Figure 4. When you complete this, it is time to interface the A/D converter to your computer. First, connect the computer's ground to the A/D converter's ground and connect the +12V line from the computer to V+ of the circuit. (If you would prefer not to utilize the computer's 12V supply, connect two 9V batteries, in series, between ground and V+.) Then, connect a wire from the pull-up resistors to the +5V supply of the computer. Now, connect the eight output bits from the converter to an eight bit input port on your computer. Finally, attach one bit of an output port to the unconnected lead of R4. The converter is now electrically interfaced. Software, however, is necessary for its operation.

1. Power up the converter. (Through batteries, power supplies, etc. The pull-up resistors R5-12 may be connected to V+ for this test.)
2. Apply a 200 Hz square wave to the base of Q2. (If you do not have a signal generator, a 555 pulse circuit will suffice.)
3. Connect the oscilloscope's vertical input to the collector of Q2.
4. Connect the oscilloscope's "external triggering input" to the square wave source. Adjust for a stable display.
5. The oscilloscope should display a sawtooth waveform. (R3 may have to be adjusted to achieve this.)
6. Connect the arms of a potentiometer to V+ and ground, and attach its wiper to the input of a comparator.
7. View the signal at the output of the same comparator.
8. As you adjust the knob on the potentiometer, the width of the displayed square wave will vary. At the knob's two extremes, a straight line may appear on the oscilloscope. This is normal.
9. If time permits, repeat steps 5-7 for the remaining seven comparators.

Figure 4. Triggered oscilloscope testing procedure.

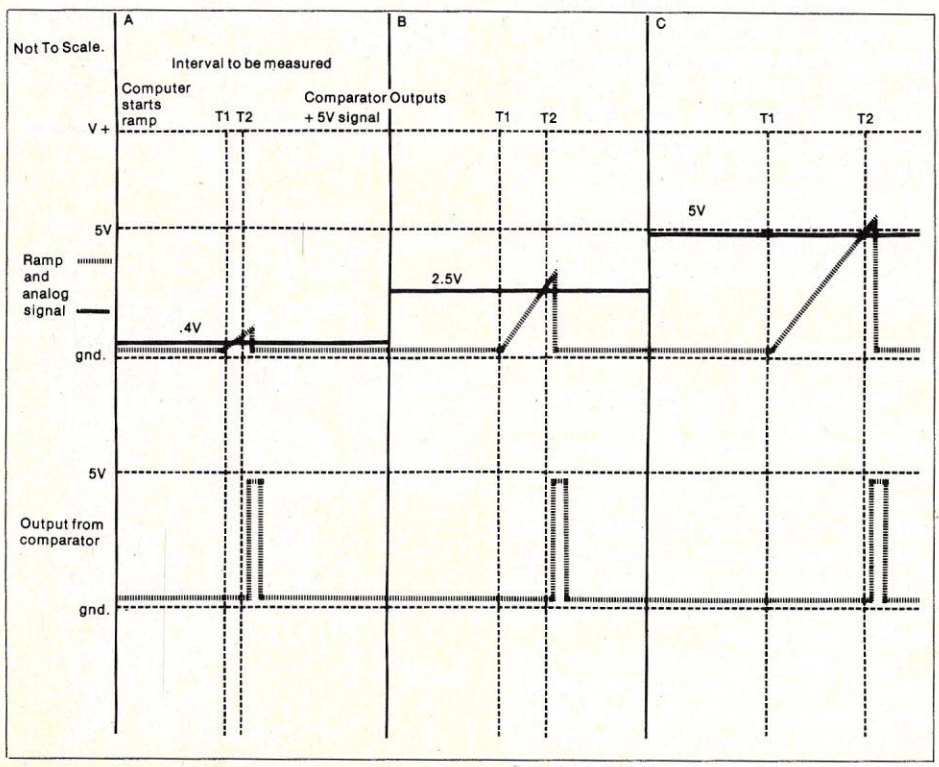
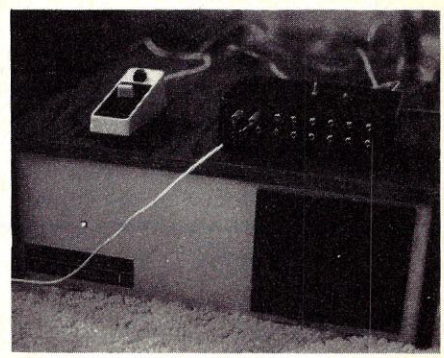


Figure 3. Timing diagram of ramp, analog input and output from comparator.



The Software

Due to the many different processors and programming languages in use, the conversion program is presented in the form of a flowchart. (refer to Figure 5). Normally, this flowchart would be implemented in machine language. A BASIC program would utilize the converter through the USR function. If the BASIC program requires a scaled value between, say, 0 and 15, the following type of statement is used: LET S = INT ((VALUE/255)*15) + 1.

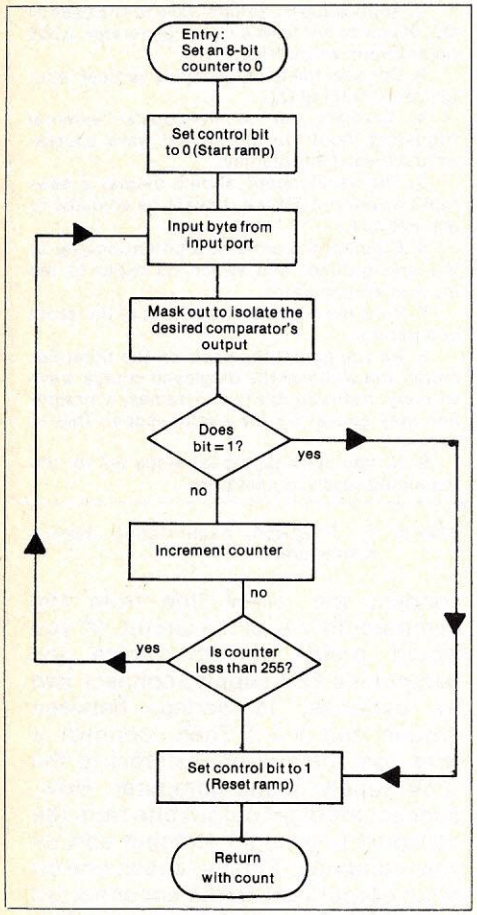
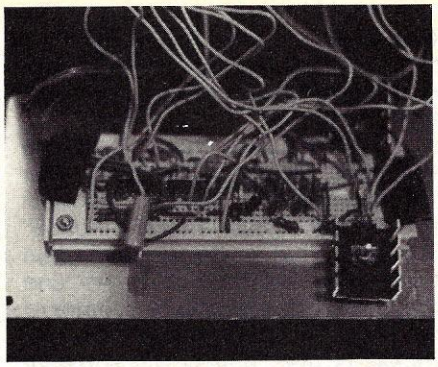


Figure 5. Flowchart of a machine language conversion program.

(VALUE represents the number returned by the conversion software, and S is the scaled result).

If you are not adept at machine language, there is an alternative method: By greatly increasing the value of C1, the ramp's rate of increase will slow down. This will allow a BASIC version of the conversion software (using the INP and OUT functions) to operate. I do not recommend this technique because it might take several seconds for the BASIC conversion program to convert a voltage, as compared to only microseconds for a machine language program. Interestingly, a Z80 owner, programming in machine language, might have to decrease the value of C1, due to the high speed of his machine.



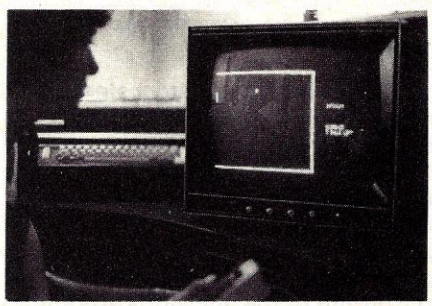
Once the speed of the converter is approximately equal to that of its companion software, R3 is used to precisely match them. First, set up a temporary routine that will call the conversion program, display the value of the analog input at channel one and then loop back and repeat. Then apply +5V to the corresponding input, input one. Adjust R3 to its minimum resistance, then begin to increase its value. Note that the displayed conversion value is increasing. When the displayed value passes 200, begin to slow down the rate at which you are turning the knob. When the value reaches 254, continue turning the knob on R4, but only enough to make the value 255. Then stop turning. the A/D converter is now operational. In conjunction with its associated software, it will convert an analog input voltage between 0 and 5V to a corresponding number from 0 to 255.

Applications

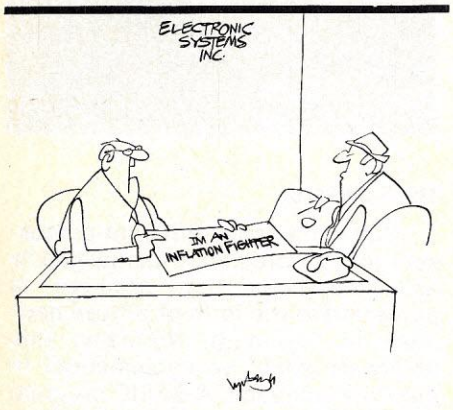
The most obvious application of this A/D converter is to digitize the position of a slide pot (paddle) or joystick (two-dimensional paddle). To do so, attach one arm of the potentiometer to +5V, one to ground and hook the wiper to an input channel. Since a joystick is made up of two potentiometers, two input channels would be used for it.

Many other applications are also possible. For example, the computer could use a thermistor to monitor the temperature. It could then record the temperature over a period of time, or perhaps act as an "intelligent" thermostat. If the converter is utilized in conjunction with some type of moisture-sensing circuit, the computer could alert you when your basement floods. If you are not present, it could activate a sump pump.

The A/D converter can, if accurately calibrated, act as a test instrument. It could measure voltage or even capacitance. To measure capacitance, the computer would monitor the charge rate of the unknown capacitance in series with a known, fairly large, resistance. Using this data the computer could determine their time constant. Dividing the time constant in seconds by the resistance in ohms would yield the capacitance in Farads.



An A/D converter enables a digital computer to observe the real world, which is analog in nature, on its own terms. Information that was previously inaccessible to computer analysis can now be utilized in an ever increasing number of varied applications. The A/D converter is a tool whose value depends, like all other tools, upon the skill and imagination of its user. □



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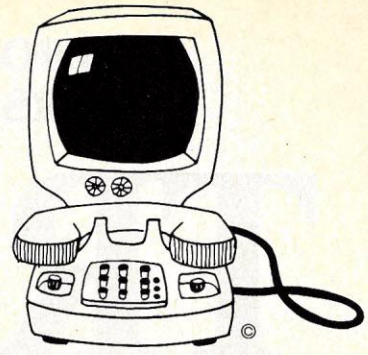
CIRCLE 134 ON READER SERVICE CARD

A simple telephone dialer BASIC program for the North Star, TRS-80 and other popular systems.

Telephone Dialer



Gene Christianson

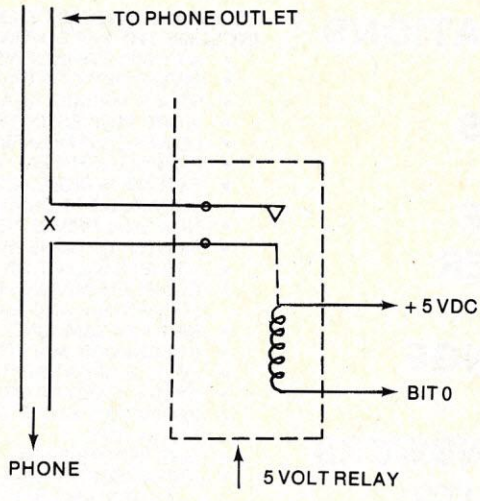
Have you ever wished you owned one of those fancy phone dialers which store 32 numbers? Do you find yourself redialing the same busy number over and over again until your finger is about ready to fall off? How would you like to store several hundred of your favorite phone numbers by name or number? For about three dollars in parts, one bit on a parallel port and the program included in this article you can do just that!

Software

The program is written in North Star BASIC and with a few changes, described at the end of the article, it will run on TRS-80 or similar BASIC. The program uses an if-then lookup table to convert a name label to a number. On input the computer will take up to 11 digits or characters. Starting at Line number 63 the program converts the input string to a number and pulses a small relay (see Figure 1) to do the dialing. You will have to play with the timing loops at line numbers 70, 83, 87 and 102 for your computer's speed and local phone system. My timing works well with an 8080-A running at 2 Mhz. and a very fast touch tone phone system. Line number 89 will wait for long distance dial tone if the first number in the dialing sequence is a "1." When you hear the tone, just hit 'RETURN.'

Hardware

A 6-9 volt SPDT relay from Radio Shack sells for $3.00 and is the only hardware needed. Almost any low voltage relay will do the trick. Make sure the current rating does not exceed the rating of the port. Most latched ports will sink about 50 mA. Use the LSB (bit 0) of a latched parallel port. Hook one leg of the relay coil to the +5 volt supply on the board that the parallel port is on. Hook the other end to the first bit (bit 0) on the port. The relay contacts are in series with the phone line. I broke the red wire and spliced the normally open contacts between the break. You will want to put a SPST switch across the relay contacts. This overrides the relay when the computer is off so you may use the phone normally. Check local phone restrictions, you may need a DAA to connect the relay. You can check your installation before running software by sending OUT statements to the port the relay is on. In the immediate mode type 'OUT (port #),1'. With the override switch off this will turn the phone on. Type OUT (port#),0 and you should hear the phone hang up. Set P1 in line number 18 to the port address you are using for the relay.



Gene Christianson & Associates, Box 267, Santa Barbara, CA 93102.


```
1  REM  ****** PHONE DIALER *******
2  REM
3  REM  COPYRIGHT 1979 BY  GENE CHRISTIANSON
4  REM                     BOX 267
5  REM                     SANTA BARBARA, CA 93102
6  REM                     PHONE 805-682-5693
7  REM
8  REM THIS PROGRAM MAY BE USED FOR NON COMMERCIAL USE
9  REM
10 REM REVISION 6/15/79
11 REM
12 REM
13 REM ***** LIST OF VARIABLES *******
14 REM
15 REM   F= ON\OFF HOOK
16 REM   I= LOCAL VARIABLE
17 REM  P1= PORT OF DIALER
18 P1=110
19 REM   M= A$(POSITION)
20 REM   N= NUMBER IN QUE BEING DIALED
21 REM   T= PORT OF CONSUL
22 T=2
23 REM   A$= NUMBER BEING CALLED
24 REM   B$= LABEL ASSOCIATED WITH PHONE #
25 REM   Z$= LOCAL ONLY
26 REM
27 REM
28 DIM A$(11), B$(11)
29 GOSUB 114 \ REM CLEAR SCREEN
30 GOSUB 106 \ REM MAKE SURE LINE IS ON HOOK!
31 INPUT "NAME OR NUMBER TO DIAL > ", A$
32 IF LEN(A$)=0 THEN 30
33 B$=C$
34 IF A$(1,1)>"9" THEN 120\ REM LOOK UP STRING
35 REM
36 REM THIS IS THE RE-ENTRY POINT FROM ASCII LOOK UP
37 REM
38 GOSUB 114
39 IF F=1 THEN !"***** O F F   H O O K *****"\!
40 IF F=0 THEN !"O N  H O O K "\!
41 FOR I=1TO LEN(A$)
42 PRINT A$(I,I)+" ",
43 IF LEN(A$)=7 AND I=3 THEN !"- ",
44 IF LEN(A$)>8 AND I=1 THEN !"- ",
```

Dialer, con't...

```
45 IF LEN(A$)>8 AND I=4 THEN !"- ",
46 IF LEN(A$)>8 AND I=7 THEN !"- ",
47 IF LEN(A$)=8 AND I=1 THEN !"- ",
48 IF LEN(A$)=8 AND I=4 THEN !"- ",
49 NEXT
50 !"    ",B$    \  REM PRINT LABEL WITH NUMBER IT FOUND
51 PRINT
52 PRINT
53 FOR I=0TOLEN(A$) \ !"^ ", \ NEXT
54 IF LEN(A$)>8 THEN !"^ ^ ",
55 !"  OK? CR= DIAL / KILL  N= NEW ",
56 Z$=INCHAR$(T)
57 GOSUB 114 \ REM CLEAR SCREEN
58 IF Z$= "N" THEN 106
59 IF F=1 THEN 106
60 I=0 \ D=0
61 GOSUB 97 \ REM PICK UP PHONE AND HOLD A MOMENT
62 REM
63 REM THIS STARTS THE DIAL SEQUENCE
64 REM
65 !"D I A L I N G  S T A R T E D " \ !
66 FOR M=1 TO LEN(A$) \      REM CONVERT STRING
67 N= VAL(A$(M,M))    \      REM TO NUMBER AND DIAL
68 !N,
69 Q=0
70 FOR Q=1TO 250\ NEXT \ REM THIS WAITS BETWEEN PULSES
71 IF LEN(A$)=7 AND M=3 THEN !" -",
72 IF LEN(A$)>8 AND M=1 THEN !" -",
73 IF LEN(A$)>8 AND M=4 THEN !" -",
74 IF LEN(A$)>8 AND M=7 THEN !" -",
75 IF LEN(A$)=8 AND M=1 THEN !" -",
76 IF LEN(A$)=8 AND M=4 THEN !" -",
77 IF N=0 THEN N=10
78 REM
79 REM  THIS IS THE PULSE SUBROUTINE
80 REM
81 FOR D= 1 TO N
82 OUT P1,0 \ REM OPEN CONTACTS ON RELAY
83 FOR I=1TO10\NEXT
84 REM
85 REM
86 OUT P1,255 \ REM CLOSE CONTACTS ON RELAY
87 FOR I=1TO20\NEXT
88 NEXT D
89 IF M=1 AND N=1 THEN INPUT1 " ",Z$ \ REM THIS HOLDS FOR LONG
90 REM                                    DISTANCE CALLS USING
91 REM                                    "1" AS THE FIRST DIGIT
92 NEXT M
93 PRINT CHR$(7)
94 GOSUB 114
95 GOTO 39 \ REM END OF SEQUENCE
96 REM
97 REM THIS IS THE PICK UP SET
98 REM
99 F=1 \ REM THIS FLAGS OFF HOOK CONDITION
100 !"P I C K I N G  U P  L I N E ..."\!
101 OUT P1,255 \ REM PICK UP LINE
102 FOR I= 1TO 200 \ REM WAIT A WHILE
103 NEXT
104 RETURN
105 REM
106 REM KILL CALL IN PROGRESS
107 REM
108 OUT P1,0
109 F=0 \ REM THIS FLAGS ON HOOK
110 GOSUB 114
111 IF Z$=CHR$(13) THEN 39
112 GOTO 31
113 REM
114 REM THIS CLEARS SCREEN ON SORROC
115 REM
116 ! CHR$(27),"*"," "
117 !CHR$(27),"=","*"," "
118 RETURN
119 REM
120 REM THIS IS THE LOOK UP TABLE FOR NAME TO NUMBER CONVERSION
121 REM
122 B$=A$ \ REM THIS CLEARS LABEL STRING
123 IF A$="HELP"        THEN A$="911"
124 IF A$="TIME"        THEN A$="9660611"
125 IF A$="DOCTOR"      THEN A$="6879444"
126 IF A$="LA INFO"     THEN A$="12135551212"
127 IF A$="SF INFO"     THEN A$="14155551212"
128 IF A$="SB INFO"     THEN A$="15551212"
129 IF A$="KABC"        THEN A$="12135205222"
130 IF A$(1,1)>"9"      THEN B$=C$ \ REM CLEAR LABEL
131 IF A$(1,1)>"9"      THEN 31 \ REM GO HOME IF NOT FOUND
132 GOTO 36
```

Using the system

Just add your names and phone numbers to the IF-THEN list starting at line 123 and you're ready to go. The list will only be limited by the amount of memory your machine has. Remember to resave the program as you add more numbers and names. Simply type a name or number and hit RETURN. The software checks to see if you are giving it a name or a number. If it gets a number it starts right into the dialing loop. If it is trying to match a name you have typed in, it goes to the lookup table at line number 120 and tries to find a match. In the event the software finds no match with the name you submit, it will just return to the input loop in line number 31.

Changes for TRS-80 style BASIC

The short form for PRINT in North Star BASIC is an exclamation mark, which will have to be changed to "?" (or something else if your BASIC uses a shorthand for PRINT). Change the following lines to read:

```
34 IF LEFT(A$,1) > "9" THEN 120
42 PRINT MID$(A$,I,I) + "-",
56 INPUT " ",Z$
76 N = VAL(MID$(A$,M,M))
130 IF LEFT$(A$,1) > "9" THEN
  B$ = C$ \REM CLEAR LABEL
131 IF LEFT$(A$,1) > "9" THEN
  31\REM GO HOME IF NOT
  FOUND
```

For those with an aversion to keying in programs from magazines, the phone dialer is available for $10 on North Star diskette from Gene Christianson & Associates, Box 267, Santa Barbara, CA 93102.

The more adventurous programmers might consider modifying the program to log phone calls (for accounting purposes) and to provide an interactive method of entering and changing numbers. □

"DEAR COMPUTER"

Dear Computer:

I recently ordered a female robot from Texas Robotics. In most ways she (it) performs satisfactorily. However, the other night she (it) went out without asking my permission. I later learned that she (it) had gone to a N.O.W. meeting. Does she (it) have the right to do this?

— Disgruntled Bachelor

Dear Chauvinist:

Tough break old chap. Women's lib is here in spirit as well as in fact. You might try an inflatable doll.

Steve M. Aldridge

Teacher-Made Tests: Debugging & Evaluating

Douglas W. Green
Dr. Jeffrey Hering

Using the classroom computer for administering tests is in fairly widespread use today. Now teachers will be able to evaluate the effectiveness of those tests...and find out where and how to improve them.

In theory, student evaluations determined from teacher-made tests are supposed to show how well each learning objective was taught and how well each student is performing relative to the entire class. In practice, tests composed by teachers are used to generate necessary grades and, if the scores are acceptable, forgotten until the next time. One reason for this is the vast amount of time required to do the type of statistical analysis necessary to locate the "bugs" in one's lesson plans as well as the tests themselves.

The lesson plan "bugs" may be spotted by the results of an item analysis of the test. This may be nothing more than a list of how many students missed each question. In the case of multiple choice tests, it can also include the frequency of selection for each of the available answers. Armed with this information the instructor can then try to determine if the questions missed most often were a result of inadequate teaching of the objective being tested, or if the concepts involved were beyond the mental maturity level of the students being tested.

Finding the bad questions in a test is another, more complex problem from a statistical point of view. A bad question can be defined as one answered correctly by students possessing less understanding. It is desirable to have test questions that will be answered correctly more often by the students who understand the material than by those who do not. Unfortunately, this is not always the case. To find the "klunkers" among the questions on a test, a statistic known as the point bisereal coefficient can be used.

Douglas Green & Dr. Jeffrey Hering, Cortland Junior-Senior High School, Science Dept., Valley View Drive, Cortland, NY 13045.

The coefficient can be determined for each question on a test using the equations presented in Figure 1. The values of r will vary from +1 to -1 without ever reaching these extremes. If the students answering a question correctly have a higher average score on the test than the students missing the question, r will be positive. From the viewpoint of the test maker a positive r value is desirable, although it may not be significant if it is too low. A t-test, using the formula $t = r(N-2)/(1-r2)$, can be used to test for significance by referencing a standard t-test table. In this equation, N is the number of tests, N-2 is the number of degrees of freedom and the sample distribution is considered to be two-tailed. This t-test is not a part of the program presented here, however.

Equations Needed To Calculate The Point Biserial Correlation Coefficient

$$r_{pbi} = \frac{(\bar{X}p - \bar{X}q)}{S.D} \sqrt{pq}$$

r_{pbi} = point biserial coefficient
$\bar{X}p$ = the average grade of the students answering a question correctly
$\bar{X}q$ = the average grade of the students answering a question incorrectly
p = the fraction of the students answering a question correctly
q = the fraction of the students answering a question incorrectly
S.D. = the value of the standard deviation that can be found using the equation below

$$S.D. = \sqrt{\Sigma(X - \bar{X})^2 / N}$$

X = the test score for a given student
$\bar{X}$ = the average of all of the scores
N = the number of students in the sample

Figure 1.

The more positive the value of r, the better job the question did in separating students who know the concepts being tested from those who do not. An r value of zero implies that the question did not discriminate at all, which is the case when everyone gives the same answer for a question. Negative values indicate that the question did just the opposite of what it should have done. One thing that any test-maker does not want is the poorer students answering correctly more often than the better students. This is what a negative value of r indicates.

The Program

The program presented here has been designed to generate an item analysis along with the value of the point biserial correlation coefficient for each question. It was written using a Wang 2200 with 8K bytes of memory, and makes use of Wang's version of BASIC. It can analyze the results of any exam where the questions have answers that are either correct or incorrect. Specifically, however, it was designed for exams composed of multiple choice type questions having four choices each. It also allows for exams that are composed of two parts in which the second part of the test is composed of several optional groups of questions. This is the type of exam given by the New York State Board of Regents in all of its science courses. The chemistry exam, for example, contains 60 questions on Part One that every student must answer. Part Two is composed of nine groups that contain five questions each. Here each student must select any six of the nine groups for a total of 30 questions. The program was designed specifically to allow for the variety of answers such an exam presents, but it works just as well for shorter tests that have only one part.

The program contains nine sections that each perform an integral part of the task (Figure 2). The first part involves setting up or dimensioning the data tables. Matrix A$ has been dimensioned to contain up to 120 answers for each of 30 students, along with the correct answers. The statement DIM A$(120,31)1 means that the computer saves space in its memory for a table of alphanumeric data composed of 120 rows and 31 columns, and that each piece of data is limited to values composed of a single character. The table is alpha-

numeric so that it will take up less space in the memory. A comparable data table composed of numeric values would occupy 13 times as much space. In addition to the A$ table, there is also a list called C$ that contains the scores of each student and a list called C that contains the number of students that select each of the groups of questions on Part Two of the exam.

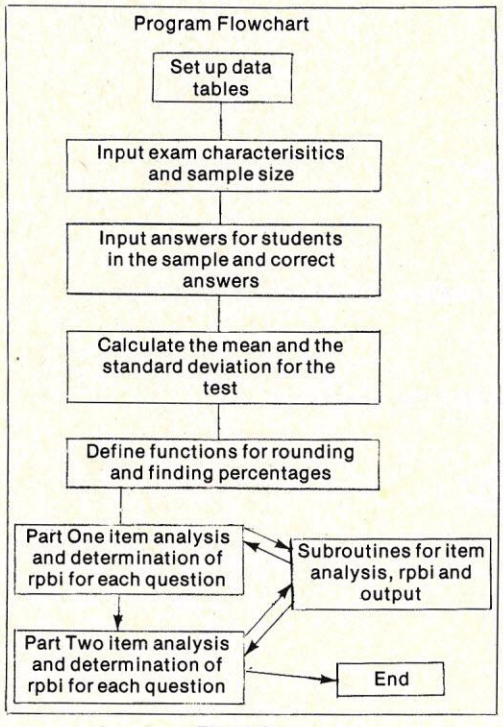

Program Flowchart
Set up data tables
Input exam characterisitics and sample size
Input answers for students in the sample and correct answers
Calculate the mean and the standard deviation for the test
Define functions for rounding and finding percentages
Part One item analysis and determination of rpbi for each question
Subroutines for item analysis, rpbi and output
Part Two item analysis and determination of rpbi for each question
End

Figure 2.

The next segment of the program contains the input statements that provide the computer with the exact nature of the test. The number of parts and the makeup of each are supplied by the operator when these statements are executed. This is followed by the sections containing the input statements that ask the operator for the answers of each of the students in the sample of tests being analyzed, along with the correct answers. After the final pieces of data have been entered, the computer encounters the statements that lead it through the processing of the data and the production of the desired output.

The first portion of this task involves the calculation of the mean, or the average score on the test and the standard deviation. This is a measure of how far the scores tend to be spread from the mean. The larger the value of the standard deviation, the farther the scores are spread from the average score. Since numeric operations like addition and division cannot be performed on alpha-numeric variables, the data must first be converted to numeric form before it can be operated on. This involves the use of the CONVERT function. If a statement reads CONVERT C$(N) to X, it simply means that the Nth value in the alphanumeric list called C$ is to be converted to the numeric value X. This must also be done during the item analysis segment of the program.

As processing continues, the program contains statements that involve several user defined functions. These make use of the DEFFN statement and are used to make sure that the output of the program is properly rounded off and that the number of students selecting each of the available choices is converted to a percentage of the total. Next the statements that do the item analysis for Part One are encountered. The program instructs the computer to evaluate one question at a time by making use of nested loops with an inner loop that evaluates each question and an outer loop that advances the analysis from one question to the next. After the answer for a student is converted to numeric form, it is evaluated by an ON...GOSUB statement. The numbers after the word GOSUB are the statement numbers that contain subroutines to be called, depending on the value of the variable being evaluated. If the value is one, then the subroutine beginning at the first statement number is called and so on. In this manner, the number of 1's, 2's, 3's, and 4's are counted up by the four, short subroutines found at the end of the program. This part of the program also contains a statement that calls the subroutine that determines the value of r. Finally, the results of the analysis of each question are printed out. To do this, a PRINTUSING statement is used. If a statement reads PRINTUSING, 40,X, Y,Z, the computer would print the values for X, Y and Z according to the format given in statement number 40. Statement 40 in this case would be called an image statement and might look like this: 40 % ###.# ###.# ###.#. The percent sign tells the computer that it has encountered an image statement. The number signs (#) are used to tell the computer how the values to be printed should be arranged in the program's output.

The item analysis for Part Two proceeds in much the same way with a few exceptions. First, the number of each question is determined by an equation using the variables that were input to describe the number of questions in each part of the exam and assigned to the variable K. Second, if a question was not selected, it must be skipped over and this is done by an IF...THEN statement that looks like: IF A$(K,M) = " " THEN 860. If a question was not answered, the value stored for it in the A$ matrix will be equal to a space. An IF...THEN statement of the form given does nothing more than look for spaces so the computer will not be sending out an error message when it tries to unsuccessfully convert a space to a numeric value.

The final part of the program is the subroutine that determines the value of r for each question. This is com-

Variables Used In The Program And Their Meanings:

- A counter for the number of 1's in item analysis A$( ) 120 by 31 matrix that holds the answers given by the students along with the correct answers
- B counter for the number of 2's in item analysis
- C counter for the number of 3's in item analysis
  C( ) list that counts the number of students who select each of the groups on Part Two of the test.
  C$ ( ) list of the scores for up to 30 students
- D sum of the grades for the students who answered each question correctly
  D1 number of students who answered each question correctly
  D2 average grade of the students who answered each question correctly
  D3 counter for the number of 4's in item analysis
- E sum of the grades for the students who answer each question incorrectly
  E1 number of students who answered each question incorrectly
  E2 average grade of the students who answered each question incorrectly
- F sum of all of the grades
- G number of the group being input and a loop counter
  G2 number of groups on Part Two of the exam
  G3 number of groups on Part Two that each student must answer
- H loop counter
- I standard deviation
- J counter used in the determination of the standard deviation
- K question number for the questions in Part Two
- L mean of all the scores
- M loop counter
- N loop counter
- P fraction of students answering a question correctly
- Q fraction of students answering a question incorrectly
  Q1 number of questions on Part One of the test
  Q2 number of questions in each group on Part Two of the exam
- R number of students selecting a given question
  R1 value of the point biserial coefficient for each question
- S number of students in the sample
- W dummy variable used in the user-defined functions
- X numberic variable use to hold individual grades and choices during determination of the mean, standard deviation, item analysis, and point biserial coefficient

Figure 3

Teacher-Made, con't...

posed of a loop that compares the answer given by each student selecting each question to the correct answer. After this is done, the student's score is either added to the scores of the students who missed the question or to the scores of the students who answered the question correctly. The number of students in each category are also counted before the loop is finished. Next, the average grades of the students in each group are determined, along with the percentage in each. With all of the preliminaries out of the way the equation for the calculation of r is finally reached. To help follow the meaning of the program the variables used are defined in Figure 3.

Sampling The Population

Ideally, the classroom teacher should use a random sampling procedure to select the sample of tests for evaluation from the total population. If the members of the population are listed in a grade book, they can be numbered consecutively. When you have determined the number of students to be sampled, divide the total number of students by this number. If you get a decimal, increase the value to the next highest integer. This integer will tell you which students to pick from the list. If the integer is 5, then choose every 5th name on the list. This method, known as systematic sampling, will produce a sample that can be regarded as random for most practical cases.

Other methods of selecting the sample could involve entering the student numbers on slips of paper and drawing them from a container, or reading the numbers of the students to be used from table of random numbers which can be found in most statistics texts. If time is a factor and the results are not being prepared for publication, a number of student papers can be selected from each class as long as the papers have been well shuffled.

For the statistic being used, the distribution is approximately normal for samples of 30 or more. This means that there is little value to be gained by evaluating more than 30 samples, especially if entering the data is a time-consuming process. If the population is less than 30 then the entire population should be used. If 30 tests are used, then the value of r is significant at the 0.5 level if it is equal to or greater than 0.36.

Entering Data

For the user of this program the process of entering data is rather straightforward. The computer will

```
10 REM * SET UP DATA TABLES *
20 REM **********************
30 DIM A$(120,31)1,C$(30)3,C(10)
40 REM * ENTER DATA DESCRIBING EXAM *
50 REM ******************************
60 INPUT "HOW MANY STUDENTS? MAX 30",S
70 PRINT "THE MAXIMUM NUMBER OF QUESTIONS ON THE EXAM IS 120"
80 INPUT "HOW MANY QUESTIONS IN PART I",Q1
90 INPUT "HOW MANY GROUPS IN PART II",G2
100 IF G2 = 0 THEN 150
110 INPUT "HOW MANY QUESTIONS IN EACH GROUP",Q2
120 INPUT "HOW MANY GROUPS MUST EACH STUDENT ANSWER",G3
130 REM * INPUT DATA FOR EACH STUDENT *
140 REM *******************************
150 FOR N = 1 TO S
160 FOR M= 1 TO Q1
170 PRINT "STUDENT";N;"QUESTION";M
180 INPUT A$(M,N)
190 NEXT M
200 IF G2 = 0 THEN 300
210 PRINT "STUDENT NO.";N
220 FOR M = 1 TO G3
230 INPUT "GROUP#",G
240 C(G) = C(G)+1
250 FOR Q = (Q2*G+Q1-Q2+1) TO (Q2*G+Q1)
260 PRINT "QUESTION#";Q
270 INPUT A$(Q,N)
280 NEXT Q
290 NEXT M
300 INPUT "ENTER GRADE",C$(N)
310 STOP "ENTER ANY CHANGES FOR THIS STUDENT IN IMMEDIATE MODE."
320 NEXT N
330 REM * ENTER CORRECT ANSWERS *
340 REM **************************
350 FOR N = 1 TO Q1+G2*Q2
360 PRINT "ENTER CORRECT ANSWER FOR QUESTION NUMBER";N
370 INPUT A$(N,S+1)
380 NEXT N
390 STOP "ANY CHANGES"
400 REM * MEAN AND STANDARD DEVIATION *
410 REM *********************************
420 FOR N = 1 TO S
430 CONVERT C$(N) TO X
440 F = F+X
450 NEXT N
460 L = F/S
470 FOR N = 1 TO S
480 CONVERT C$(N) TO X
490 J = J+(L-X)↑2
500 NEXT N
510 I = (J/S)↑.5
520 REM * DEFINE FUNCTIONS *
530 REM ***********************
540 DEFFN1(W) = INT((W*100/S)+.5)
550 DEFFN2(W) = INT(W*100/C(G)+.5)
560 DEFFN3(W) = INT(W*100+.5)/100
570 DEFFN4(W) = INT(W*100+.5)
580 REM * ITEM ANALYSIS FOR PART I *
590 REM ******************************
600 GOSUB 1360
610 FOR N = 1 TO Q1
620 A,B,C,D3 = 0
630 FOR M = 1 TO S
640 CONVERT A$(N,M) TO X
650 ON X GOSUB  1280,1300,1320,1340
660 NEXT M
670 GOSUB 940
680 %###   ###   ###   ###   ###   ###   #.##       ###
690 %###   ###   ###   ###   ###   ###   ####     #########
700 PRINTUSING 680,N,FN1(A),FN1(B),FN1(C),FN1(D3),A$(N,S+1),FN3(R1),FN4(P)
710 NEXT N
720 REM * ITEM ANALYSIS FOR PART II *
730 REM *******************************
740 IF G2 = 0 THEN 1230
750 FOR G = 1 TO G2
760 A,B,C,D = 0
770 PRINT HEX(0A0E);"GROUP";G;"SELECTED BY";FN1(C(G))
780 GOSUB 1360
790 FOR H = 1 TO Q2
800 A,B,C,D3 = 0
810 FOR M = 1 TO S
820 K = ((G-1)*Q2+Q1+H)
830 IF A$(K,M) = " " THEN 860
840 CONVERT A$(K,M) TO X
850 ON X GOSUB 1280,1300,1320,1340
860 NEXT M
870 GOSUB 940
880 PRINTUSING 680,K,FN2(A),FN2(B),FN2(C),FN2(D3),A$(K,S+1),FN3(R1),FN4(P)
890 NEXT H
900 NEXT G
```

```
910 GOTO 1230
920 REM * Rpbs AND % CORRECT *
930 REM ************************
940 E,E1,D,D1,R = 0
950 FOR M = 1 TO S
960 IF K = 0 THEN 980
970 N = K
980 IF A$(N,M) = " " THEN 1080
990 R = R + 1
1000 IF A$(N,M) = A$(N,S+1) THEN 1050
1010 CONVERT C$(M) TO X
1020 E = E + X
1030 E1 = E1 + 1
1040 GOTO 1080
1050 CONVERT C$(M)TO X
1060 D = D + X
1070 D1 = D1 + 1
1080 NEXT M
1090 IF D1 = 0 THEN 1170
1100 IF E1 = 0 THEN 1170
1110 D2 = D/D1
1120 P = D1/R
1130 E2 = E/E1
1140 Q = E1/R
1150 R1 = ((D2-E2)/I)*((P*Q)↑.5)
1160 GOTO 1220
1170 R1 = 0
1180 IF D1 = 0 THEN 1210
1190 P = 1
1200 GOTO 1220
1210 P = 0
1220 RETURN
1230 PRINT "MEAN = ";FN3(L)
1240 PRINT "STD. DEV. = ";FN3(I)
1250 GOTO 1390
1260 REM * COUNTERS FOR ITEM ANALYSIS *
1270 REM ******************************
1280 A = A+1
1290 RETURN
1300 B = B+1
1310 RETURN
1320 C = C+1
1330 RETURN
1340 D3 = D3+1
1350 RETURN
1360 SELECT PRINT 215
1370 PRINTUSING 690,"NO.","%1","%2","%3","%4","ANS","Rpbs","%CORRECT"
1380 RETURN
1390 END
```

print the number of the student and the number of the question prior to the input of each piece of data. For this reason, it might be a good idea to number the tests in your sample. Even though the user needs to make two consecutive mistakes to enter an erroneous piece of data, it does seem to happen. To correct such mistakes, all the user need do is continue on until the last piece of data has been input for that student. The computer then encounters a STOP statement and puts the system into immediate mode. Now the operator types in the corrections. For example, suppose the operator gave the wrong input for question 15 for student 7, and that the answer that should have been input was choice 3. By typing A$(15, 7) = "3" and executing, the error has been corrected. Once this has been done, the operation of the program may be continued and the answers of the next student can be input.

For systems that are not interactive, the program can be revised with little difficulty so that data can be supplied by READ statements rather than INPUT statements. Some operators of interactive systems might even consider this a more desirable method for supplying data for the program. Better yet would be a system composed of some sort of mark sense reader that could read the student's choices directly from their answer sheets. Although such systems exist in the larger computer centers they may not be as available to most teachers as the smaller systems similar to the one this program was developed for.

If there are true/false, fill in the blank, or other non-multiple choice questions, they can be handled by assigning an answer a 1 if the question is correct and 2 if it is incorrect. Although the item analysis for such questions will provide less information, the value of r will be just as meaningful.

Interpreting The Output

This is where the actual debugging takes place (See Figure 4). By looking for the questions that were missed more often than not and by looking for low or negative values of r, a teacher can serve to improve the test itself as well as the lesson plans that lead up to it. The questions having low, percent correct values show where further teaching time should be spent. The wrong choices selected most frequently may point to common misunderstandings that can be addressed during future classes. Questions having negative values of r should be discarded or written again. They are usually questions where too much knowledge proved to be a dangerous thing. Teachers do not usually intend to construct tricky test questions but somehow they seem to show up no matter how much time you spend preparing them. By using a computerized analysis such as this one, you can improve your overall teaching effectiveness while doing a better and fairer job of discriminating between the students who have reached your teaching objectives and those who have fallen short. □

Sample Output

NO.	%1	%2	%3	%4	ANS	Rpbs	% CORRECT
1	20	10	10	60	4	0.45	60
2	6	57	19	20	2	0.21	57
3	0	5	90	5	3	-0.11	90
4	75	10	10	5	1	0.39	75
5	42	35	13	10	2	0.54	35

GROUP 1 SELECTED BY 80%

No.	%1	%2	%3	%4	ANS	Rpbs	% CORRECT
6	100	0	0	0	1	0.00	100
7	50	25	25	0	4	0.00	0

GROUP 2 SELECTED BY 60%

NO.	%1	%2	%3	%4	ANS	Rpbs	% CORRECT
8	72	5	5	18	1	0.67	72
9	15	5	7	73	4	0.02	73

GROUP 3 SELECTED BY 60%

No.	%1	%2	%3	%4	ANS	Rpbs	% CORRECT
10	82	3	4	11	1	0.54	82
11	5	10	54	31	4	0.74	31

MEAN = 5.54 STD. DEV. = 2.54

This is the output for a two part multiple choice test where each student answers all five questions on part one and two of the three groups on part two. By looking at the column labeled Rpbs, one can tell: that question 3 was missed more often by the better students, questions 6 and 7 did not descriminate at all, and the Rpbs value for question 9 is very low. These are the questions that should be considered for revision the next time the test is given.

Figure 4

Adventure

Ben Moser

Adventure is one of the only classic computer games to develop a legendary reputation solely by word-of-mouth. The original version (by Crowthers and Woods) exists in various FORTRAN incarnations on timesharing systems, but unfortunately these are not easily transported to a personal computer because the game runs entirely in memory and won't fit in 64K.

However, there have been conversions of Adventure to mini and microcomputers. The version published here is in HP3000 BASIC and uses disk files to store descriptions and messages. Conversion to a microcomputer is probably possible but will require a fully expanded machine. (48K of memory and at least 128K of disk storage would be a good start). Naturally, you can scale the game down or add your own features once you've figured out how it works.

If you don't want to do all the typing and modification, Adventure is available on cassette and floppy disk from several software companies (including Creative Computing Software). There is a bi-lingual version of the original Adventure written in SAM76 language, and several different Adventure-style games written by Scott Adams. The Adams games (see Creative Computing, August 1979) are actually one very generalized Adventure interpreter and then an Adventure database, which allows for the creation of many different games. [In comparing the Adams Adventures to the Crowthers and Woods original, the original game has longer descriptions and seems a bit more awesome, but the Scott Adams Adventures require more thinking and the themes are more sophisticated (or at least different than) the original.] — SN

Adventure Background

I originally played Adventure on one of MIT's timeshare computers. One day last year I decided to try to write a BASIC version of the game. I played MIT's game so much that I mapped most of the game and had lists of room names, directions in which to move and names of objects.

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Using my data, I wrote a HP2000 version that was full of bugs and was generally a total flop. Last fall (November 1978) I gained access to HP3000 BASIC, which allows a program approximately four times as large as the HP2000. Also, I had use of a large amount of disk space. Since HP3000 BASIC is a superset of that of the 2000, I was able to write a very good imitation (in my opinion) of MIT's game.

The game of Adventure was originally conceived at MIT by Don Woods and Willie Crowther. I've taken their game layout and created a program that does most of the things their program does, and I have added little in the way of innovative ideas (i.e., new rooms, objects, villains, etc.).

The latest version of Adventure/3000 seems to work very well. However, it may still contain some bugs. Unfortunately, I can no longer use the school's HP3000, as all the disk space is now full of FORTRAN files belonging to other students. Therefore, this is the final version, unless someone types it into another HP3000 and hacks around with it some more.

Adventure/3000—General Ideas, Layout and Purpose

Adventure is a fascinating fantasy game in which the player first starts out near a small house. He is allowed to use various English commands to move himself and to manipulate objects. When he enters the house he finds objects such as food, water, a lamp and a set of keys. Armed only with these items, he sets out to explore the surrounding countryside in search for the entrance to a mysterious cavern. Inside the cavern are all sorts of goodies (and "baddies," for that matter!)—more objects, treasures and various entities that attack, steal, or otherwise impede the player's explorations. Using his intellect, the player must figure out how to manipulate certain things in his favor. For instance, he brilliantly deduces that to unlock something he should use his keys. When the player finds a treasure he is supposed to put it back in the house so he will receive the maximum number of points for it. The exploration of the cave can take hours of real time, and often an inexperienced player is stymied by seemingly insurmountable obstacles (how does one cross a wide fissure?)

Adventure/3000—Explanation of the Variables and Their Uses

Arrays:

S(x) "Stuff" array. Keeps track of the location of various objects used in the game. X ranges from 1 to T2 (the total # of objects). If X = 0 then it is not currently used in the game; if X = -1 then the object is in the player's possession; otherwise X = the code # of the room in which the object is located.

K(x) The keyword array. Used to store keyword code numbers of any keywords found in a command string. If the user entered "GET BIRD," then K(124) and K(31) would both be set = 1.

V(x) Indicates whether a person has visited room X before. (Tells whether to print a long or a short room description if user wants "brief" descriptions.) Also used in scoring.

O(15) Stores relative skill values for finding each treasure. Used only in scoring.

Simple numeric and string variables:

T1 = total # of locations (rooms)
T2 = total # of items (or objects)
T3 = The number of the highest keyword code #
L1 = Current location of player
L2 = Previous location of player. (Not used in my game... would be used if "GO BACK" were in my game)
G = Status of Grate. (0 = locked; 1 = unlocked)
BO = Contents of the Bottle. (0 = empty; 1 = water; 2 = oil)
S = Snake. (1 = blocking the way; 0 = gone for good)
D1 = Status of Dragon. (1 = blocking the way; 0 = dead and harmless)
T = Troll. (0 = gone; 1 = demanding treasure; 2 = lurking under bridge; 3 = paid for the moment)
B1 = Bear. (0 = ferocious; 1 = friendly but captive; 2 = freed)

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B2 = Status of Crystal Bridge. (0 = absent; 1 = present)
P1 = Size of Plant. (0 = dinky; 1 = half grown; 2 = full grown and climbable)
D2 = Status of rusty iron door. (0 = closed, locked; 1 = opened)
DO = Flag for degree of detail when giving descriptions. (0 = short; 1 = long; 2 = brief)
L = Lamp. (0 = off; 1 = lit)
C = Status of Chain. (0 = locked to wall, bear; 1 = unlocked)
D3 = Dwarf flag. (1 = dwarf has thrown (given away) the axe, otherwise D3 = 0)
B3 = Bird flag. (0 = bird is loose; 1 = he's in the cage.)
RO = # of times the player has been reincarnated after dying.
CO = Flag to indicate if player has a loaded game. He is only allowed to load once. (=1 if game was loaded from a save file; otherwise = 0)
Z's = Are trash variables used mainly for returning values from subroutines, temporary storage, etc.

Adventure 3000—Description of Major Segments of The Program

10 to 260 Initialize the variables, print instructions.
270 to 550 For each turn, describe room, list objects there, GOSUB for dwarves and pirate, input command string (C$), do each "sentence" (substring A$), keep getting A$'s until LEN(C$) = 0.
560 to 1100 Pull keywords out of A$. Each keyword encountered is recorded in K(x).
1110 to 1930 These do the moving of the player. Checks are also made for special move conditions / restrictions. If a dwarf was in your room, he would follow you.
1940 to 2110 See if player wanted a command (not a compass direction). If so, it branches to the given command (in line 2100).
3590 to 3910 (GET) First it checks for "ALL" (K(47) would = 1) The program checks for all items specified in K(x) and acts accordingly (i.e., it "gets" the requested goods if special "get" conditions are met). If K(item code #) = 0 then that item is skipped over.
3920 to 4150 (DROP) Similar in structure to (GET), this routine "drops" the requested items if they are being carried.
4160 to 4420 (THROW) This command has several uses. One is to kill dwarves by throwing the axe at them. Another is to toss a treasure to the greedy troll. If none of the above are applicable, then the specified item is simply dropped.
4430 to 6400 These are shorter routines to handle some of the other commands. Most routines here may be easily deciphered by consulting charts detailing room, object and location codes and names.
6410 to 6640 The "score" command plus a subroutine that is called by Score (line 9760). Score returns two variables: SO (= current score) and Z9 (= total # of rooms visited so far). Player gets some credit for simply finding a treasure, and gets an equal additional amount for placing it back in the house (L1 = 7). See loop from 6540 to 6590. Line 6600 simply gives the player additional points for his ingenuity (i.e., give him 10 points for opening the grate, in which case G = 1).

6660 to 6770 List items at current location (L1). Items are stored in file #1. There are T2 items to worry about.
6880 to 7360 This segment of code makes sure that all conditions are met to get a particular item. For example, it checks to see if it is legal to get the bird, bear, chain, etc.
7370 to 7610 Checks for special "drop" conditions. Similar to special "get" conditions, except not all the restrictions are identical. Example: one may "GET MING VASE," but if you "DROP MING VASE" and there is no pillow on the floor, the vase will shatter into worthless crockery. (7550-7610)
7620 to 7780 A quasi - ingenious method of outputting text in the game. Through the use of a multiline function, I need only specify a code number and the corresponding message is printed from file #3. Example: Z9 = FNA(402) will print Adventure's instructions. This is used in lines 60-90.
7800 to 7980 Checks to see if additional descriptions are needed, depending mainly on location. Example: tell player whether or not grate is locked if he's at location #7.
7990 to 8230 These two routines print out a description of the player's surroundings.
8250 to 8380 Look for first item mentioned in command string.
8390 to 8450 Finds first item in room (if any).
8460 to 8540 Makes sure player has item #Z3. Returns Z5 = 1 if he has it; Z5 = 0 if he does not.
8550 to 8790 Controls placement and attacking for dwarves. Randomly puts dwarves in a room, or makes them attack.
8800 to 8960 The pirate decides whether or not to rob the player. If he does steal his treasures, the pirate places them in his hideout (L1 = 100).
8970 to 9070 Save a game.

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9080 to 9210 Load an old game. You can only do this once, to avoid cheating.

9220 to 9320 A silly routine to read a magazine (currently useless).

9330 to 9530 Allows users to report bugs. Bug file may then be read by programmer at a later time.

9540 to 9770 Reincarnation routine. Player only goes through this if he fell or jumped into a pit (fatal) or got knifed by a dwarf.

9780 to 8950 Check to see if player has fallen into a pit.

9860 to 9940 Get a YES (Z0 = 1) or NO (Z0 = 0) reply from user.

Addenda

Adventure/3000 makes use of several weird functions which are probably unique to Hewlett-Packard BASIC. More information may be obtained by reading one of HP's esoteric BASIC manuals.

(line 30) FILES. Open the disk files. Files are subsequently referred to by number, i.e., #3 is for "AMESSAGE." A * reserves buffer space so that a file may be opened later using the ASSIGN statement.

(50) INTEGER. Declares variables to be 2 byte integers. This is optional; it simply saves a little memory space.

(420) LINPUT. Like INPUT, but accepts an entire line which can contain blanks, commas and quotes.

(9350) ASSIGN (file/name), (file number), (return variable) Example: ASSIGN "BUG," 5,R tries to open file #5 named "BUG." The r is a return variable. If it's not 0 then the file is not open for read/write access. In line 9500 ASSIGN *,5 closes file #5. (This must be done before assigning a new file to #5).

Crazy Functions:

(500 & 860) POS(A$,B$) returns a number indicating where B$ occurs first in A$. Example: POS("CPU," "P") returns 2 since "P" is the second character in "CPU."

(440) UPS$ (string). Changes any lowercase letters to uppercase.

(20) DAT$ (1,27). Returns a string with current date and time.

(460) NUM (string). Performs the same function that ASC does in Microsoft BASICs: returns a decimal value of an ASCII character.

(250, 9180) MAT READ. Read a matrix from data. In 250, 0(15) means to read 15 numbers into 0(x). A similar statement in line 9180 (MAT READ #) reads arrays from a disk file.

(6680) READ # (filenumber), 1. This statement rewinds a file to its first record (start of file). Read # (filenumber); (data list) reads data values from a disk file.

(9030, 9040) PRINT #. MAT PRINT #. These are used to store data in a disk file.

(9380) ADVANCE. In my program I use this to go to the logical end of the file so that new data may be written to it.

(530, 7700) CONVERT (string) to numeric variable, [(optional line # to branch to in case of error)]. This is used in line 530 to see if player entered a room code #. If he did, then the computer makes it his new location. Otherwise A$ is treated as a normal command. In line 7700, this function simply converts a string to a number.

"If I wanted something almost human, I'd of gone to an employment agency."

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(170, 180) MAT (name) = ZER. Sets the elements of (name) array to 0. FNA (X). In this program, you specify a x for a specific message, and the function prints the corresponding message out of a file. This is explained elsewhere. ON END # (filenumber) THEN. Transfers control to a given line # when an end of file is reached.

Additional Notes:

In string literals one may encounter strange expressions, as in line 410, which reads PRINT '7'27. This means to print a bell and then an escape character. '(number) represents an ASCII character, i.e., '10 = CHR$ (10).

Line 410 prints a " > " prompt in inverse video on an HP2640 terminal (optional).

Lines 520 to 540 can be deleted. These were used for debugging the game. (A player could type a room code # and he would be popped to the appropriate location. Obviously, if this is left in, it will allow cheating).

For Those Trying To Understand How The Program Works

Adventure/3000 can be divided into several parts, as I have outlined in my description of the major segments of the program. The main parts are (not necessarily in order): Initialization, command input loop, command interpretation, command execution and data statements.

Moving is done mainly by entering compass directions which have values as follows: 1 = North, 2 = Northeast, 3 = East, 4 = Southeast, 5 = South, 6 = Southwest, 7 = West, 8 = Northwest, 9 = up, and 10 = down. In my game I have 100 locations, each with a total of 10 possible directions in which to move. I chose to store 100 strings, each of ten characters in a file called "AMOVING." When the player wants to move, the computer finds the L1th string in this file (i.e., indicating the ways he can move from his present location), takes the decimal of the D'th character (corresponding to the direction the player intends to move), looks at this value and decides: (1) that the player can't move that way (= 0); (2) that he can move that way without restriction (in which case the number = the new room code; or (3) the number = 255 which means that the program should check that the player can move legally and in which direction. □

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This game was inspired by the huge Adventure game which has appeared on large mainframe computers the last several years. But there are important differences. Not only will **ADVENTURE** fit into a relatively small computer, but the 'interpreter' is designed so that different Adventures can be created by changing the data base. So look for more Adventures in the future...

In playing the game you wander thru various 'rooms' (locations), manipulating the objects there to try to find 'treasures'. You may have to defeat an exotic wild animal to get one treasure, or figure out how to get another treasure out of a quicksand bog. You communicate thru two-word commands such as 'go west', 'climb tree', 'throw axe', 'look around'.

Six Different Adventures

ADVENTURELAND (by Scott Adams) - You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter WILD ANIMALS, MAGICAL BEINGS, and many other perils and puzzles. Can you rescue the BLUE OX from the quicksand? Or find your way out of the maze of pits? Happy Adventuring.....

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PIRATE ADVENTURE (by Scott Adams) - "Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover LONG JOHN SILVER's lost treasures? Happy sailing matey.....

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ORIGINAL ADVENTURE (by Crowther, Woods, Manning and Roichel) - Somewhere nearby is a collosal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual**—you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required for SAVE GAME feature). Even includes SAM76 language in which to run the game. The troll says "Good Luck."

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CS-3010 TRS-80 16K Level II (Machine language)	$14.95
CS-3507 TRS-80 32K Disk (Includes Mission Impossible)	$24.95
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THE COUNT (by Scott Adams) - You wake up in a large brass bed in a castle somewhere in Transylvania. Who are you, what are you doing here, and WHY did the postman deliver a bottle of blood? You'll love this Adventure, in fact, you might say it's LOVE AT FIRST BITE.....

CS-3011 TRS-80 16K Level II (Machine language, available Nov.)	$14.95

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```
 DUMP AITEMS/FOOBAR
There is a large sparkling nugget of gold here!
There are bars of silver here!
There is precious jewelry here!
There are many coins here!
There are several diamonds here!
There is a delicate, precious ming vase here!
To one side lies a glistening pearl!
There is a nest here, full of golden eggs!
There is a jewel-encrusted trident here!
There is an emerald the size of a plover's egg here!
There is a platinum pyramid here, eight inches on a side!
There is a golden chain here.
There are rare spices here!
There is a valuable persian rug here!
There is a chest here, full of various treasures!
There is a bottle of water here.
There is a small pool of oil here.
There is a brass lantern here.
There is a set of keys here.
There is food here.
There is a glass bottle here.
There is a small wicker cage here.
There is a 3-foot black rod here.
There is an enormous clam here with its shell tightly shut.
There is a recent issue of "Spelunker Today" here.
There is a bear nearby.
There is a little axe here.
There is a purple velvet pillow here.
There are shards of pottery scattered about
There is an enormous oyster here with its shell tightly shut.
There is a little bird here.
A burly troll stands in front of you.
A huge fierce green dragon bars the way!
A huge fierce green snake bars the way!
There is a threatening little dwarf in the room with you!
>DUMP ADESCRIP/FOOBAR
You're in forest.
You're in forest.
You're in forest.
You're in forest.
You're at hill at end of road.
You're at road near house.
You're inside house.
You're beside a stream in a valley.
You're near the slit in the streambed.
You're directly above a grate in a dry streambed.
You are below the grate.
You're in cobble crawl.
You're in the debris room.
You are in an awkword sloping e/w canyon.
You're in the bird chamber.
You're at top of small pit.
You're in hall of mists.
You're in the nugget of gold room.
You're on east side of fissure.
You're on the west side of the fissure.
You are at the west end of the hall of mists.
You are in the hall of the Mountain King.
You're in the south chamber.
You're in the west chamber.
```

```
You are at a N/S passage at a hole in the floor.
You're at "Y2".
You are near a window overlloking the pii.
The passage here is blocked by a recent cave-in.
You're at east end of long hall.
You're at west end of long hall.
You are at a crossover of a high N/S canyon and a low E/W one.
Dead end.
You are in a dirty broken passage.
You're at brink of small  it.
You are in a little pit which as a stream flowing through it.
You are in a room full of dusty rocks.
You're at a complex junction.
You are in the anteroom.
You're at Witt's End, with passages off in *** ALL *** directions.
You are in the shell room.
You are in an arched hall.
You are in a steep sloping corridor.
You are in a cul-de-sac about 8 feet across.
You are in bedquilt.
This is the swiss cheese room.
You are in the soft  oom.
You at east end of twopit room.
You are at the west end of the twopit room.
You're in east pit.
You're in west pit.
You are in the slab room.
This is the oriental room.
You are in a large low room.
You are in a sloping corridor.
You are at a dead end of the crawl.
You are in a misty cavern.
You are in an alcove.  A green glow comes from the east.
You are in the plover room.
You're in dark room.
You are on the SW side of the troll's bridge.
You are on the NE side of the troll's bridge.
You are in an E/W corridor.
You're at fork in path.You
You are in a N/S limestone passage.
You're at junction with warm walls.
You are in the chamber of boulders.
You're at a breath-taking view.
You are outside a barren room.
You are inside a barren room.
You are in a long narrow E/W corridor.
You'reein the giant room.
The passage here is blocked by a recent cave-in.
You are at one end of an immense N/S passageway.
You're in a cavern with a waterfall.
You are at the top of a steep incline above a large room.
You are in a secret N/S canyon above a sizable passage.
You're at top of stalactite.
You are at the junction of three secret canyons.
You are in a secret N/S canyon above a large room.
You are in the canyon with the mirror.
You are at the underground reservoir.
You are in a secret canyon with exits to N and E.
You are in a secret E/W canyon above a tight canyon.
You are at a wide place in a very tight N/S canyon.
The canyon becomes too tight to continue.
```

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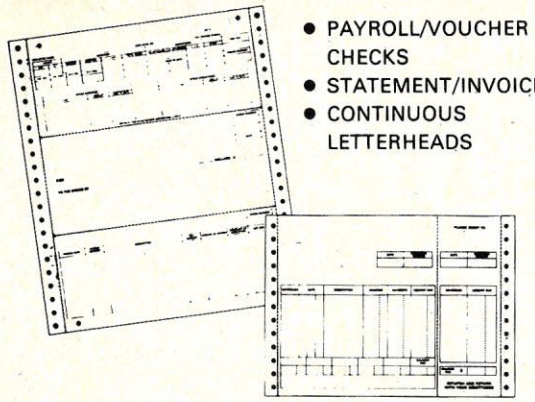

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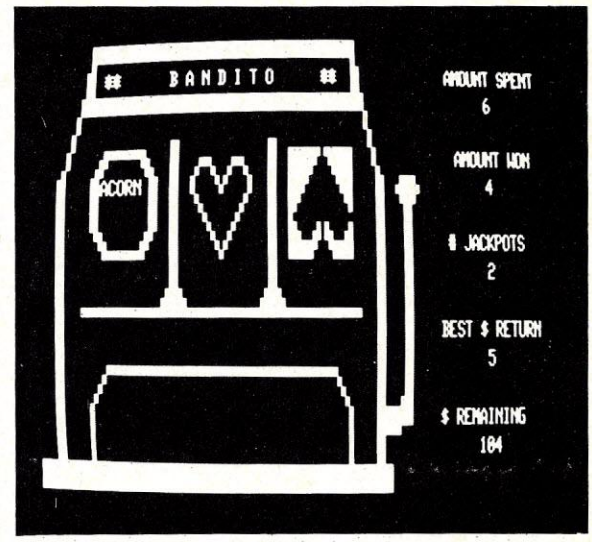

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CIRCLE 104 ON READER SERVICE CARD

```
You are in a tall E/W canyon.
The canyon runs into a mass of boulders--dead end.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are in a maze of twisty little tunnels, all alike.
You are a a huge orange stalactite in the maze.
You are in a maze of twisty little tunnels, all alike.
You are at a dead end.
>DUMP AMESSAGE/FOOBAR
#1
You can't move that way.
#2
Nothing happens.
#2.1
Nothing seems to happen.
#2.2
I don't think that had any affect on anything.
#2.3
I don't know how to apply that word in this situation.
#2.4
That had little effect, if any at all.
#3
The fissure is too wide to jump.
#4
You are at the bottom of a pit with a broken neck.
#5
The bottle is already filled!
#6
The bear eagerly wolfs down the food and becomes calm and friendly.
#7
The plant surges upwards, reaching halfway to the hole above you.
#8
The plant grows explosively, almost filling the bottom
of the pit.
#9
You overwatered the plant, you fool!
#10
The grate is locked.
#11
The grate is unlocked.
#12
The bear is quite ferocious, and will no doubt tear you to
shreds if you approach it!
#13
The chain is unlocked and the bear is free.
#14
A crystal bridge now spans the fissure.
#15
The bridge vanishes.
#16
It is beyond your power to do that
#17
The clam opens momentarily, and a glistening pearl falls out
and rolls away.  Goodness, this must really be an oyster.
```

```
(I never was any good at identifying bivalves, anyway.)
#18
I can't close that!
#19
The oil has freed-up the hinges, and with a slight push
the door squaks open.
#20
I can't eat.
#21
How can I drink that?
#22
"Glug, glug, glug, Belch!"
#23
It doesn't want to eat anything (except maybe you!)
#24
You fool! Dwarves only eat coal! Now you've made him
*** REALLY  MAD ****!
#25
Trolls are brothers of the rocks and have skin like that
of a rhinocerous. He fends off your blows effortlessly.
#26
The troll catches the axe, examines it, and tosses it back to
you saying, "Good workmanship, but not very valuable."
#27
The troll catches your treasure and scurries away.
#28
The bear lumbers toward the troll, who emits a shriek
and flees in terror. The bear soon gives up pursuit.
#29
You attack a dwarf, but he jumps out of the way.
#30
You killed a little dwarf. The body vanishes in a cloud
of greasy black smoke.
#31
There is a threatening litle dwarf in the room with you!
#32
One sharp nasty knife is thrown at you!
#33
A bearded pirate steps from the shadows. "Har har",he chortles,
"I'll jest take this booty an' hide it in me chest deep in the
maze!" He snatches your treasure and vanishes into the gloom.
#34
There are strange whispering noises from the darkness behind you.
#35
The grate is open.
#36
The grate is locked
#37
The bird was unafraid when you entered, but it becomes frightened
and it flutters up out of your reach.
#38
The dome is unclimbable.
#39
A crystal bridge spans the fissure.
#40
A huge fierece green snake bars the way!
#41
A hollow voice says "Plugh."
#42
The vase is now resting on the pillow.
#43
```

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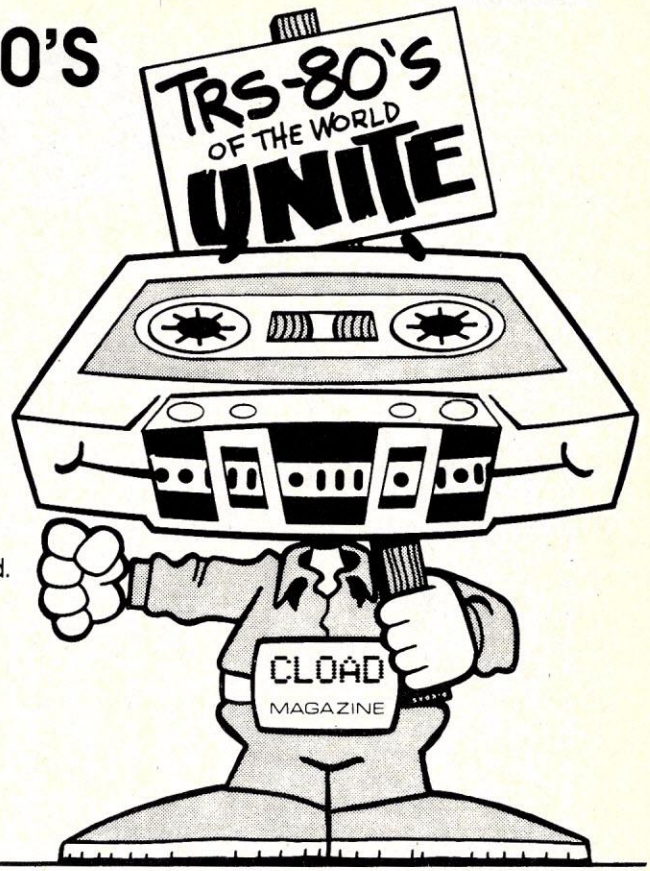

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Crash! Tinkle! The ming vase shatters into worthless crockery.
#44
You fell into a pit and broke every bone in your body!
#45
It is now pitch dark. If you proceed you may fall into a pit.
#46
The nest of eggs has vanished!
#47
There is a tiny plant here, murmuring "water, water".
#48
There is a twelve-foot beanstalk poking out of the pit,
bellowing "Water! Water!"
#49
A giant beanstalk stretches clear to the celing and through
the hole at the top.
#50
You can't get by the snake.
#51
The dragon has a rather "volatile" personality, and he will
probably incinerate you if you get any closer.
#52
You have crawled through some little holes and have wound up
back in the main passage
#53
Something you're carrying won't fit throught the tunnel.
#54
Your load is too heavy. You'd best take inventory and drop
something first.
#55
The troll insists you throw him a treasure before you may cross.
#56
The troll pops from under the bridge and blocks your way.
#57
A rusty iron door obstructs the passage to the north.
#58
The bear will bite off your hand. Besides, the chain is locked to the wal
#59
It's rather difficult to move a twenty-ton dragon, considering
he is lying on the rug.
#60
The vase is now resting on the pillow.
#61
A valliant attempt!
#61.1
Nice try!
#61.2
A valliant attempt, but you're not that strong!
#61.3
Don't be silly!
#61.4
Do you have any idea on how to do that?
#62
a huge dragon blocks the way. The dragon is lying
on a persian rug!
#63
A burly troll stands beside the bridge, blocking your way.
#64
There is a ferocious cave bear eyeing you from the end
of the room!
#65
The bear is locked to wall by a golden chain!

#66
There is a calm, friendly bear locked to the wall.
#67
You are being followed by a large friendly bear.
#68
With what? Your bare hands?
#69
Congratulations! You have just killed a huge dragon
with your bare hands (hard to believe, ain't it?)
#70
Attacking it is both dangerous and doesn't work.
#71
There is nothing here to attack.
#72
How can you do that to more than one thing at a time?
#73
Thanks, it was delicious!
#74
I see nothing special about that.
#75
Oh dear, you seem to have gotten yourself killed. Do you
want me to try and patch you?
#76
Ok, but don't blame me if something goes wr
---POOF---
You are engulfed in a cloud of thick orange smoke, and
you emerge coughing and gasping, and find that...

#77
You clumsy oaf, you've done it again!
I don't know how long I can keep this up...
#78
I'm all out of orange smoke, and you've used up
all your available lives. Better luck next time!
#79
The nest of golden eggs has vanished!
#80
A little dwarf just walked around a corner, threw a little axe at
you which missed, cursed, and ran away.
#81
The nest of golden eggs has re-appeared!
#200
You are in a forest, with trees all around you.
#205
You have walked up a hill, still in the forest.
The road slopes back down the other side of
the hill. There is a building in the distance.
#206
You are standing at the end of a road before a small
brick building. Around you is a forest. A small stream
flows out of the building and down a gully.
#207
You are inside a building, a well house for a large
spring.
#208
You are in a valley in the forest beside a stream
tumbling along a rocky bed.
#209
At your feet all the water of the stream splashes into
a 2-inch slit in the rock. Downstream the streambed is bare rock.
#210
You are in a 20 foot depression floored with bare dirt.

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Set into the dirt is a strong steel grate mounted in concrete.
A dry streambed leads into the depression.
#211
You are in a small chamber beneath a 3x3 steel grate to the surface.
A low crawl over cobbles leads inward to the west.
#212
You are crawling over cobbles in a low passage. There is a dim light
at the east end of the passage.
#213
You are in a debris room filled with stuff washed in from the surface.
A low wide passage with cobbles becomes plugged with mud and debris
here, but an awkward canyon leads upward and west. A note on the wall
says "Magic Word Xyzzy".
#214
Your are in an awkward sloping east/west canyon.
#215
You are in a splendid chamber thirty feet high. The walls are frozen
rivers of orange stone. An awkward canyon and a good passage exit
from east and west sides of the chamber.
#216
At your feet is a small pit breathing traces of white mist. An east
passage ends here except for a small crack leading on.

Rough stone steps lead down the pit.
#217
You are at one end of a vast hall stretching forward out of sight to
the west. There are openings to either side. Nearby, a wide stone
staircase leads downward. The hall is filled with wisps of white mist
swaying to and fro almost as if alive. A cold wind blows up the staircas
There is a passage the the top of a dome behind you.

Rough stone steps lead to the top of the dome.
#218
This is a low room with a crude note on the wall. The note says,
"You won't get it up the steps!"
#219
You are on the east bank of a fissure slicing clear across the hall.
The mist is quite thick here, and the fissure is too wide to jump.
#220
You are on the west side of the fissure in the hall of mists.
#221
You are at the west end of the hall of mists. A low wide crawl continues
west and another goes north. To the south is a little passage six feet
off the floor.
#222
You are in the hall of the Mountain King, with passages off in
all directions.
#223
You are in the south side chamber.
#224
You are in the west side chamber of the hall of the Mountain King.
A passage continues west and up here.
#225
You are in a low N/S passage at a hole in the floor. The hole goes down
to an E/W passage.
#226
You are in a large room, with a passage to the south, a passage to the
west, and a wall of broken rock to the east. There is a large "y2" on
a rock in the room's center.
#227
You're at a low window overlooking a huge pit, which extends up out of yo

sight. A floor is indistinctly visible over 50 feet below. Traces of
white mist cover the floor of the pit, becoming thicker to the right.
Marks in the dust around the window would seem to indicate that
someone has been here recently. Directly across the pit from you and
25 feet away there is a similar window looking into a lighted room. A
shadowy figure can be seen there peering back at you.

The shadowy fighure seems to be trying to attract your attention.
#228
The passage here is blocked by a recent cavein.
#229
You are at the east end of a very long hall apparently without side
chambers. To the east a low wide crawl slants up. To the north a
round two foot hole slants down.
#230
You are at the west end of a very long featureless hall. The hall
joins up with a narrow north/south passage.
#231
You ae at a crossover of a high N/S passage and a low E/W one.
#232
Dead end.
#233
You are in a dirty broken passage. To the east is a crawl. To the
west is a large passage. Above you is a hole to another passage.
#234
You are on the brink of a small clean climbable pit. Apassage leads west.
#235
You are at the bottom a small clean pit. A stream flows out a hole
and through some small slits in the bottom of the pit.
#236
You are in a large room full of dusty rocks. There is a big hole in
the floor. There are cracks everywhere, and a passage leading east.
#237
You are a a complex junction. A low hands and knees passage from the
north joins a higher crawl from the east to make a walking passage
going west. There is also a large room above. The air is damp here.
#238
You are in an anteroom leading to a large passage to the east. Small
passages go wwest and up. The remnants of recent diggings are evident.
A sign hanging in midair sya "Cave under construction beyond this point.
Proceed at own risk. [Witt Construction Co.]"
#239
You are at Witt's End, with passage off in **ALL** directions.
#240
You're in a large room carved out of sedimentary roc. The floor and
walls are littered with bits of shells imbedded into the stone. A
shallow passage proceeds downward, and a somwhat steeper one
leads up. A low hands and knees passage enters from the south.
#241
You are in an arched hall. A coral passage once continued up and east
from here, but is now blocked by debris. The air smells of sea water.
#242
You are in a long sleeping corridor with ragged sharp walls.
#243
You are in a cul-de-sac about eight feet across
#244
You are in bedquilt, along east/west passage with holes
everywhere. To explore at random, select pu,down, north,or south.
#245
You are in a room whose walls resemble swiss cheese. Obvious passages
go west,east,ne,,and NW. Part of the room is occupied by a large bedrock

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#246
You are in the soft room. The walls are covered with heavy curtains, the floor with a thick pile carpet. Moss covers the ceiling.
#247
You are at the east end of the twopit room. The floor here is littered with thin rock slabs, which make it easy to dessend the pits. There is a path here bypassing the pits to connect passages from east and west. There are holes all over, but the only big one is on the wall directly over the west pit where you can't get to it.
#248
You are ath the west end of the twopit room. There is a large hole in the wall above the pit at this end of the room.
#249
You are at the bottom of the eastern pit in the twopit room. There is a small pool of oil in one corner of the pit.
#250
You are in the bottom of the western pit in the twopit room. There is a large hole directly above you.
#251
You are in a large low circular chamber whose floor is an immense slab fallen from the ceiling (slab room). East and west there once were large passages, but they are now filled with boulders. Low small passages go north and south, and the south one quickly bends west around the boulders.
#252
This is the oriental room. Ancient oriental cave drawings cover the wall A gently sloping passage leads upward to the north, another passage leads SE, and a hands and knees crawl leads west.
#253
You are in a large low room. Crawls lead north, SE, and SW.
#254
You are in a long winding corridor sloping out of sight in both directions. A cold wind blows up the corridor.
#255
Dead end crawl.
#256
You are followind a wide path around the outer edge of aflarge cavern Far below, throught a heavy white mist, strange splashing noises can ne heard. The mist rises up thru a fissure in the ceiling. The paht exits to the south and west.
#257
You are in an alcove. A small NW path seems to widen after a short distance. An extremely tight tunnel leads east. It looks like avery tight squeeze. An eerie liant can be seen ath the other end.
#258
You are in a room lit by an eerie green light emanating from the walls. An extremely tight tunnel leads east, and a dark corridor lies to the NE)
#259
You're in the dark-room. A corridor leading south is the only exit. A massive stone tablet imbedded in the wall reads:
"Congratulations on bringing light into the dark-room."
#260
You are on one side of a large, deep chasm. A heavy white mistb rising up from below obscures all view of the far side. A SW path leads away.

A rickety wooden bridge extens across the chasm, vanishing inot the mist. A sign psted on tthe bridge reads, "Stop! Pay troll!"
#261
You are on the far side of the chasm. A NE path leads away from the chasm on this side.

A rickety wooden bridge extends across the chasm, vansihing into the gloom. a sign posted on the bridge reads, "Stop! Pay troll!"
#262
You're in along east/west corridor. A faint rumbling noise can be heard in the distance.
#263
The path forks here. The left fork leads northeast. A dull rumbling seems to get louder in that direction. The main corridor enters from the west.
#264
You are walking along a gently sloping north/south passage lined with oddly shaped limestone formations.
#265
The walls are quite warm here. From the north can be heard a steady roar, so loud the the entire cave seems to be trembling. Another passage leads south, and a low crawl goes east.
#266
You are in a small chamber filled with large boulders. The walls are very warm, causing the air in the room to be almost stiflingg from the heat. The only exit is a crawl heading west, through which is coming a low rumbling.
#267
You are on the edge of a breath-taking view. Far below you is an active volcano, from which great gouts of molten lava come surging out, cascading back into the depths. The glowing rock fills the farthest reaches of the cavern with a blood-red glare, giving everything an erie, macabre appearance. The air if filled with flickering sparks of ash and a heavy smell of brimstone. The walls are hot to the touch, and the thundering of the volcano drowns out all other sounds. Embedded in the jagged roff far overhead are myraid twisted formations composed of pure white alabastaer, which scatter the murky light into sinister apparitions upon the walls. To one side is a deep gorge, filled with a bizarre chaos of tortured rock which seems to have been crafted by the devil himself. An immense river of fire crashes out from the depths of the volcano, burns its way through the gorge, and plummets into a bottomless pit far off to your left. To the right,an immense geyser of blistering steam erupts continuously from a barren island in the center of a sulfurous lake which bubbles ominously. The far right wall is aflame with an incandescence of its own, which lends an additional infernal splendor to the already hellish scene. A dark, foreboding passages exits to the south.
#268
YOu are standing at the entrance to a large barren room. A sign posted above the enbtrance reads+ "Caution! Bear in room!"
#269
You are inside a barren room. The center of the room is completely empty except for some dust. Marks in the dust lead away toward the far end of the room. The only exit is the way you came in.
#270
You are in a long, narrow corrico stretching out of sight to the west. At the eastern end is a hole through which you can see a profusion of leaves.
#271
You are in the giant room. The ceiling here is too high up for your lamp to show it. Cavernous passages lead east, north, and south. On the west wall is scrawled the inscription, "fee fie foe foo" (sic).
#272
The passage here is blocked by a recent cavein.
#273
You are at one end of an immense N/S passage.

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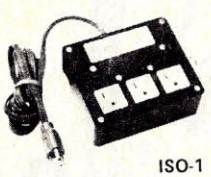
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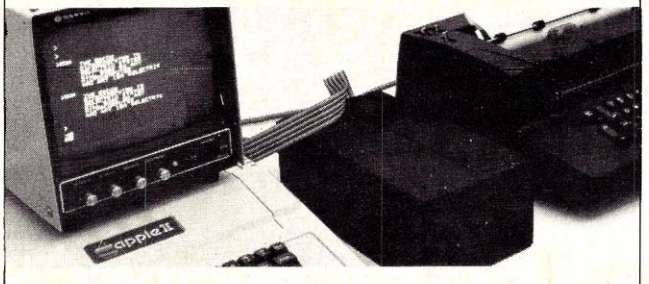

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#274
You are in a magnificent cavern with a rushing stream, which cascades over a sparkling waterfall into a roaring whirlpool which disappears through a hole in the floor. Passages exit to the south and west.
#275
You are at the top of a steep incline above a large room. You could climb down here, but you would not be able to climb back up. There is a passage leading back to the north.
#276
You are in a secret N/S canyon above a sizable passage.
#277
A large stalactite extends from the roof and almost reaches the floor below. You could climb down it, and jump from it to the floor, but having done so you would be unable to reach it to climb back up.

The maze continues at this level.
#278
You are in a secret canyon at a junction of three canyons, bearing north, south, and SE. The north one is al tall as the other two combined.
#279
You are in a secret N/S canyon above a large room.
#280
YOu are in a north/south canyon about 25 feet across. The floor is covered by white mist seeping in from the north. The walls extend upward for well over 100 feet. Suspended from some unseen point far above you, an enormous two-sided mirror is hanging parallel to and midway between the canyon walls. (The mirror is obviously provided for use by the dwarves, who, as you know, are extremely vain.) A small window can be seen in either wall, some fifty feet up.
#281
You are at the edge of a large underground reservoir. An opaque cloud of white mist fills the room and rises rapidly upward. The lake is fed by a stream which tumbles out of a hole in the wall about 10 feet overhead and splashes noisily into the water somewhere within the mist. The only passage goes back toward the south.
#282
You are in a secret canyon with exits to north and east.
#283
You are in a secret E/W canyon above a tight canyon.
#284
You are in a wide place in a very tight N/S canyon.
#285
The canyon here becomes too tight to go on.
#286
You are in a tall E/W canyon. A low crawl goes three feet north and seems to open up.
#287
The canyon runs into a maze of boulders--dead end.
#288
You are in a maze of twisty little tunnels, all alike.
#298
You are near a large pit beside a large orage stalactite in the maze. The stalactite is about 30 feet long, allowing you to descend it. However, due to the smoothness of the stalactite, you will probably be unable to climb back up again.
#300
Dead end.
#401
Welcome to adventure! Would you like instructions?
#402

Somewhere nearby is Colossal Cave, where many have found gold and treasure, though it is rumoured that some who enter are never seen again. I will be your eyes and hands. Direct me with commands such as get,take, or look. Since you need to move around, you must usually enter compass directions (N,NE,E,SE,S,SW,W,NW, or up or down), although you may sometimes use more vague verbs with which to move. I know of several objects in this game, such as a lamp and a bottle. I also know of special objects in the cave. Some of these objects have side effects, ie there is a rod in the cave that scares a little bird.

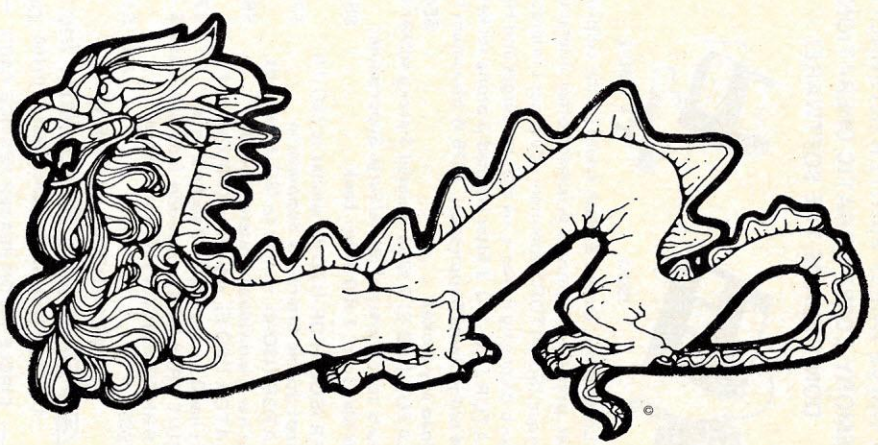
The object of this game is to gather as many treasures as you can and put them back in the house. You also run the risk of getting robbed or killed by some rather unfriendly inhabitants of the cave.

There are some useful commands that you should know about:
--- Brief, Long, and Short-these commands control the amount of
--- detail you get in descriptions.
--- Look (or L)-gives a detailed description of your surroundings.
--- Inventory (or I)-tells you what you are carrying.
--- Quit, Stop, or End--these are self-explanatory.
--- Save-by typing this, you may save your game and continue it
--- at a later time.
--- Continue- lets you continue an old game.
--- Score- tells you how well you're doing.

Other helpful functions include:
* multiple commands on one input line, ie:
"Go south. Get car, keys. Start car." (example only)

"Adventure" is a version of the game created by Willy Crowther and Don Woods at M.I.T.

#403
I'm sorry, but the magazine is written in Dwarvish.
#



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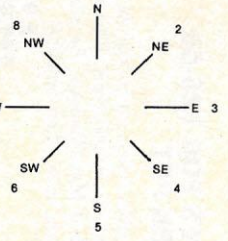

UP=9

DOWN=10

```
>RUN LIST/FOOBAR
WARNING: READ ONLY FILE IN LIST: LOCAL FILE #1
WARNING: READ ONLY FILE IN LIST: LOCAL FILE #2
LIST
START & END ROOM #S=1,100
THU, MAR  1, 1979,  8:55 PM
```

		N	NE	E	SE	S	SW	W	NW	UP	DOWN
(1)	You're in forest.	3	0	6	0	4	0	2	0	0	0
(2)	You're in forest.	1	0	8	0	2	0	4	0	0	0
(3)	You're in forest.	2	0	1	0	4	0	7	0	0	0
(4)	You're in forest.	1	0	3	0	5	0	2	0	0	0
(5)	You're at hill at end of road.	2	0	6	0	4	0	1	0	0	0
(6)	You're at road near house.	2	0	7	0	8	0	5	0	0	0
(7)	You're inside house.	0	0	0	0	0	0	6	0	0	0
(8)	You're beside a stream in a va	6	0	3	0	9	0	4	0	0	0
(9)	You're near the slit in the st	8	0	3	0	10	0	4	0	0	0
(10)	You're directly above a grate	9	0	0	0	11	0	0	0	0	11
(11)	You are below the grate.	0	0	10	0	0	0	12	0	10	0
(12)	You're in cobble crawl.	0	0	11	0	0	0	13	0	0	0
(13)	You're in the debris room.	0	0	12	0	0	0	14	0	14	0
(14)	You are in an awkward sloping	0	0	13	0	0	0	15	0	15	13
(15)	You're in the bird chamber.	0	0	14	0	0	0	16	0	0	0
(16)	You're at top of small pit.	0	0	15	0	0	0	0	0	0	17
(17)	You're in hall of mists.	22	0	0	0	18	0	19	0	16	22
(18)	You're in the nugget of gold r	17	0	0	0	0	0	0	0	0	0
(19)	You're on east side of fissure	0	0	17	0	0	0	20	0	0	0
(20)	You're on the west side of the	0	0	19	0	0	0	21	0	0	0
(21)	You are at the west end of the	20	0	20	0	88	0	29	0	0	0
(22)	You are in the hall of the Mou	25	0	17	0	23	83	24	0	17	0
(23)	You're in the south chamber.	22	0	0	0	0	0	0	0	0	0
(24)	You're in the west chamber.	0	0	22	0	0	0	31	0	31	0
(25)	You are at a N/S passage at a	26	0	0	0	22	0	0	0	0	33
(26)	You're at "Y2".	0	0	28	0	25	0	27	0	0	0
(27)	You are near a window overlook	0	0	26	0	0	0	0	0	0	0
(28)	The passage here is blocked by	0	0	0	0	0	26	0	0	0	0
(29)	You're at east end of long hal	31	0	21	0	0	0	30	0	21	31
(30)	You're at west end of long hal	31	0	29	0	94	0	0	0	0	0
(31)	You are at a crossover of a hi	32	0	24	0	30	0	29	0	0	0
(32)	Dead end.	31	0	0	0	0	0	0	0	0	0
(33)	You are in a dirty broken pass	0	0	34	0	0	0	36	0	25	0
(34)	You're at brink of small pit.	0	0	0	0	0	0	33	0	0	35
(35)	You are in a little pit which	0	0	0	0	0	0	0	0	34	0
(36)	You are in a room full of dust	0	0	33	0	0	0	0	0	25	37
(37)	You're at a complex junction.	40	0	38	0	0	0	44	0	36	0
(38)	You are in the anteroom.	0	0	39	0	0	0	37	0	37	0
(39)	You're at Witt's End, with pas	255	255	255	255	255	255	255	255	255	255
(40)	You are in the shell room.	0	0	0	0	37	0	0	0	41	42
(41)	You are in an arched hall.	0	0	0	0	0	0	0	0	0	43
(42)	You are in a steep sloping cor	0	0	0	0	0	0	0	0	40	43
(43)	You are in a cul-de-sac about	0	0	0	0	0	0	0	0	42	0
(44)	You are in bedquilt.	255	0	37	0	255	0	45	0	255	255
(45)	This is the swiss cheese room.	0	44	46	0	0	0	47	52	0	0
(46)	You are in the soft oom.	0	0	0	0	0	0	45	0	0	0
(47)	You at east end of twowit room	0	0	45	0	0	0	48	0	0	49
(48)	You are at the west end of the	0	0	47	0	0	0	51	0	0	50
(49)	You're in east pit.	0	0	0	0	0	0	0	0	47	0
(50)	You're in west pit.	0	0	0	0	0	0	0	0	48	0
(51)	You are in the slab room.	44	0	0	0	48	0	0	0	79	0
(52)	This is the oriental room.	56	0	0	45	0	0	53	0	0	0
(53)	You are in a large low room.	55	0	0	52	0	54	0	0	0	0
(54)	You are in a sloping corridor.	0	0	0	0	0	0	0	0	60	53
(55)	You are at a dead end of the c	0	0	0	0	53	0	0	0	0	0
(56)	You are in a misty cavern.	0	0	0	0	52	0	57	0	0	0
(57)	You are in an alcove. A green	0	0	58	0	0	0	0	56	0	0
(58)	You are in the plover room.	0	59	0	0	0	0	57	0	0	0
(59)	You're in dark room.	0	0	0	0	58	0	0	0	0	0
(60)	You are on the SW side of the	0	61	0	0	0	54	0	0	0	54
(61)	You are on the NE side of the	0	62	0	0	0	60	0	0	0	0
(62)	You are in an E/W corridor.	0	0	63	0	0	0	63	0	0	0
(63)	You're at fork in path.You	0	65	0	64	0	0	62	0	0	0
(64)	You are in a N/S limestone pas	63	0	0	0	68	0	0	0	0	0
(65)	You're at junction with warm w	67	0	66	0	63	0	0	0	0	0
(66)	You are in the chamber of boul	0	0	0	0	0	0	65	0	0	0
(67)	You're at a breath-taking view	0	0	0	0	65	0	0	0	0	0
(68)	You are outside a barren room.	0	0	69	0	0	0	64	0	0	0
(69)	You are inside a barren room.	0	0	0	0	0	0	68	0	0	0
(70)	You are in a long narrow E/W c	0	0	50	0	0	0	71	0	0	50
(71)	You'reein the giant room.	73	0	70	0	72	0	0	0	0	0
(72)	The passage here is blocked by	0	71	0	0	0	0	0	0	0	0
(73)	You are at one end of an immen	74	0	0	0	71	0	0	0	0	0
(74)	You're in a cavern with a wate	0	0	0	0	73	0	75	0	0	0
(75)	You are at the top of a steep	74	0	0	0	0	0	0	0	0	0
(76)	You are in a secret N/S canyon	78	0	0	0	77	0	0	0	0	45
(77)	You're at top of stalactite.	76	0	0	0	0	0	0	0	0	93
(78)	You are at the junction of thr	27	0	0	44	76	0	0	0	0	0
(79)	You are in a secret N/S canyon	80	0	0	0	82	0	0	0	0	51
(80)	You are in the canyon with the	81	0	0	0	79	0	0	0	0	0
(81)	You are at the underground res	0	0	0	0	80	0	0	0	0	0
(82)	You are in a secret canyon wit	79	0	83	0	0	0	0	0	0	0
(83)	You are in a secret E/W canyon	0	0	22	0	0	0	82	0	0	84
(84)	You are at a wide place in a v	86	0	0	0	85	0	0	0	0	0
(85)	The canyon becomes too tight t	84	0	0	0	0	0	0	0	0	0
(86)	You are in a tall E/W canyon.	45	0	84	0	0	0	87	0	0	0
(87)	The canyon runs into a mass of	0	0	0	86	0	0	0	0	0	0
(88)	You are in a maze of twisty li	89	82	91	95	90	83	92	91	95	94
(89)	You are in a maze of twisty li	95	96	91	90	89	88	91	95	93	97
(90)	You are in a maze of twisty li	92	92	91	93	88	97	88	96	99	87
(91)	You are in a maze of twisty li	91	89	94	90	93	95	89	92	0	0
(92)	You are in a maze of twisty li	95	97	93	96	94	95	21	92	0	0
(93)	You are in a maze of twisty li	90	96	92	94	88	30	92	90	0	0
(94)	You are in a maze of twisty li	88	89	90	91	89	93	95	97	0	0
(95)	You are in a maze of twisty li	93	94	96	92	97	95	94	92	0	0
(96)	You are in a maze of twisty li	92	99	97	96	89	94	90	90	91	92
(97)	You are in a maze of twisty li	98	89	92	91	90	93	94	95	96	98
(98)	You are a a huge orange stalac	95	90	93	91	94	92	90	99	98	15
(99)	You are in a maze of twisty li	88	89	93	97	100	89	96	95	0	0
(100)	You are at a dead end.	0	0	0	0	99	0	0	0	0	0

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```
A3000
  10 REM ADVENTURE/3000 VERSION 3.2        27 FEB 1979 AT 5:30 PM
  11 REM THIS PROGRAM IS RELATIVELY BUG-FREE, BUT ONE STILL MUST
  12 REM  REALIZE THAT MURPHY'S LAW STILL PREVAILS!
  13 REM
  14 REM ADVENTURE: PROGRAMMED IN HP/3000 BASIC BY BENJAMIN MOSER
  15 REM JAMES MADISON HIGH SCHOOL, VIENNA, VIRGINIA . THE BASIC LAYOUT OF THE
  16 REM GAME WAS CONCEIVED BY DON WOODS & WILLIE CROWTHER, BOTH OF M.I.T.
  17 REM
  20 PRINT "Adventure 3.2 on ";DAT$(1,27)
  30 FILES AITEMS/FOOBAR,ADESCRIP/FOOBAR,AMESSAGE/FOOBAR,AMOVING/FOOBAR&
     ,*
  40 DIM A$[100],B$[100],C$[100],D$[100]
  50 INTEGER S[99],V[100],K[200],O[15]
  60 REM ASK IF HE WANTS DIRECTIONS
  70 Z9=FNA(401)
  80 GOSUB 9860
  90 IF Z0 THEN Z9=FNA(402)
 100 REM
 110 REM INITIALIZE
 120 REM
 130 REM TOTAL ROOMS,ITEMS,AND KEYWORDS
 140 REM
 150 L1=L2=INT(RND(0)*4)+1
 160 G=0,B0=1,S=1,D1=1,D2=0,T=1,B1=0,B2=0,P1=0,L=0,C=0,D3=0,B3=0,D0=2,&
     T1=100,T2=35,T3=149,R0=0,C0=0
 170 MAT S=ZER
 180 MAT V=ZER
 190 REM
 200 REM   READ IN LOCATIONS OF ITEMS
 210 REM
 220 READ (FOR Z2=1 TO T2,S[Z2])
 230 DATA 18,25,23,24,21,52,0,71,74,58,59,69,66,82,100,7,49,7,7
 240 DATA 7,7,12,13,40,38,69,0,46,0,0,15,60,82,22,0
 250 MAT READ O[15]
 260 DATA 1,2,2,2,2,3,4,3,3,2,5,3,2,3,3
 270 REM
 280 REM  COMMAND INPUT ROUTINE
 290 REM
 300 REM PRINT ROOM, ITEMS
 310 REM IF IT'S DARK DON'T LET HIM SEE ANYTHING
 320 IF L1<13 OR L1=58 OR (L=1 AND (S[18]=L1 OR S[18]=-1)) THEN 350
 330 Z9=FNA(45)
 340 GOTO 400
 350 GOSUB D0+1 OF 6780,7990,8180
 360 IF V[L1]=0 THEN V[L1]=1
 370 GOSUB 6650
 380 GOSUB 7800
 390 REM INPUT LOOP--MULTIPLE COMMANDS;REMOVE JUNK CHARACTERS
 400 IF LEN(C$)>0 THEN 500
 410 PRINT '7'27"&dB)"'27"&d@";
 420 LINPUT C$
 430 IF C$="" THEN 410
 440 C$=UPS$(C$)
 450 FOR X=1 TO LEN(C$)
 460   Z5=NUM(C$[X])
 470   IF NOT ((Z5>64 AND Z5<91) OR (Z5>47 AND Z5<58) OR Z5=46) THEN C$&
     [X,X]=" "
 480 NEXT X
 490 IF C$[LEN(C$)]<>"," THEN C$=C$+","
 500 Z4=POS(C$,",")
```

```
 510 A$=UPS$(C$[1,Z4-1]),C$=C$[Z4+1]
 520 REM DEVELOMENTAL JUMP OPTION
 530 CONVERT A$ TO Z2,550
 540 GOTO 1180
 550 A$=" "+A$+" "
 560 REM  SEARCH A$ FOR KEYWORDS, PUT KWD CODE INTO K(X)
 570 REM ITEMS
 580 DATA 1,"GOLD",1,"NUGGET",2,"BARS",2,"SILVER",3,"JEWELRY",4,"COINS"
 590 DATA 5,"DIAMONDS",6,"MING",6,"VASE",7,"PEARL",8,"EGGS",8,"NEST"
 600 DATA 9,"TRIDENT",10,"EMERALD",11,"PLATINUM",11,"PYRAMID",12,"CHAIN"
 610 DATA 13,"SPICES",14,"PERSIAN",14,"RUG",15,"TREASURE",15,"CHEST"
 620 DATA 16,"WATER",17,"OIL",18,"LAMP",18,"LANTERN",19,"KEYS",20,"FOOD&
",21,"BOTTLE"
 630 DATA 22,"CAGE",23,"ROD",23,"WAND",24,"CLAM",25,"MAGAZINE",26,"BEAR"
 640 DATA 27,"AXE",28,"VELVET",28,"PILLOW",29,"SHARDS",30,"OYSTER"
 650 DATA 31,"BIRD",32,"TROLL",33,"DRAGON",34,"SNAKE",35,"DWARF"
 660 DATA 36,"ROCK",36,"BOULDER",37,"STAIRS",38,"STEPS",39,"HOUSE",39,&
     "BUILDING",40,"GRATE",41,"STREAM",42,"ROOM",43,"BRIDGE",44,"PIT",&
     45,"VOLCANO",46,"ROAD",47,"ALL",47,"EVERYTHING"
 670 REM DIRECTIONS
 680 DATA 100,"N",100,"NORTH",101,"NE",102,"E",102,"EAST",103,"SE",104,&
     "S",104,"SOUTH",105,"SW",106,"W",106,"WEST",107,"NW",108,"U",108,&
     "UP",109,"D",109,"DOWN"
 690 REM VERBS
 700 DATA 110,"PLUGH",111,"XYZZY",112,"PLOVER",113,"CROSS",114,"CLIMB",&
     115,"JUMP"
 710 DATA 116,"FILL",117,"EMPTY",117,"POUR",118,"LOOK",118,"L",119,&
     "LIGHT",119,"ON",120,"EXTINGUISH"
 720 DATA 120,"OFF",121,"IN",121,"ENTER",122,"LEAVE",122,"OUT",123,&
     "INVENTORY",123,"I"
 730 DATA 124,"GET",124,"CATCH",124,"TAKE",125,"DROP",125,"DUMP",126,&
     "THROW",127,"ATTACK"
 740 DATA 127,"KILL",128,"FEED",129,"WATER",130,"LOCK",131,"UNLOCK"
 750 DATA 132,"FREE",132,"RELEASE",133,"WAVE",134,"OPEN",135,"CLOSE"
 760 DATA 136,"OIL",137,"EAT",138,"DRINK",139,"FEE FIE FOE FOO",140,&
     "SHORT",141,"LONG",142,"BRIEF",143,"QUIT",143,"STOP",143,"END"
 770 DATA 144,"SCORE",145,"SAVE",146,"LOAD",147,"READ",147,"EXAMINE",&
     148,"YES",149,"BUG",150,"*"
 780 RESTORE 580
 790 MAT K=ZER
 800 Z1=0,Z3=0
 810 REM T3=TOTAL # OF KEYWORDS
 820 IF Z1>T3 THEN 900
 830 READ Z1,B$
 840 B$=" "+B$+" "
 850 REM IF KEYWORD WAS FOUND, NOTE THIS IN K(Z1)
 860 IF POS(A$,B$) THEN K[Z1]=1
 870 REM KEYWORD #Z1 NOT FOUND
 880 GOTO 820
 890 REM EXOTIC WORDS...
 900 Z0=36
 910 FOR X=Z0 TO 46
 920   IF K[X]=0 THEN 960
 930   GOSUB 6390
 940   PRINT "What do you want to do with the ";D$;"?"
 950   GOTO 410
 960 NEXT X
 970 FOR X=110 TO T3
 980   IF K[X] THEN 1950
 990 NEXT X
1000 REM THEN IT'S A DIRECTION...?
```

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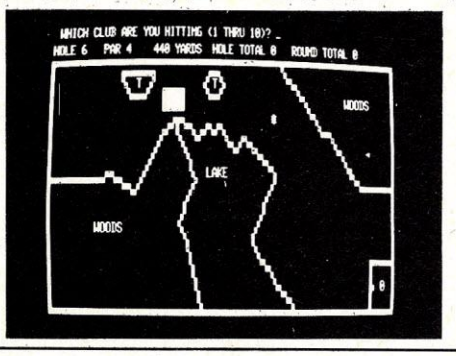

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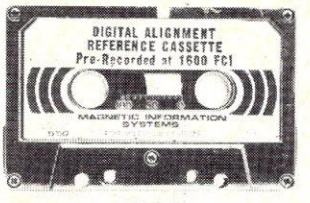

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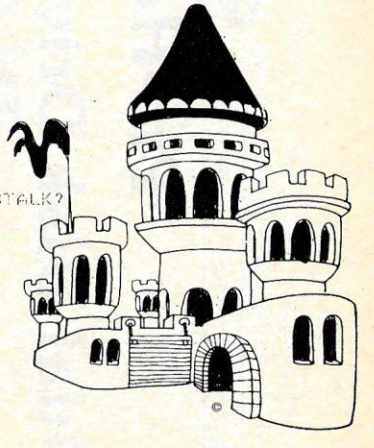
CIRCLE 161 ON READER SERVICE CARD

```
1010 FOR D=1 TO 10
1020   IF K(D+99) THEN 1070
1030 NEXT D
1040 REM COMMAND NOT A DIRECTION
1050 GOTO 1950
1060 REM CAN HE MOVE THAT WAY?
1070 READ #4,I
1080 FOR Z1=1 TO L1
1090   READ #4;A$
1100 NEXT Z1
1110 REM A$=ROOM DIRECTIONS
1120 Z2=NUM(A$(D,D))
1130 IF Z2=255 THEN 1240
1140 IF Z2<1 OR Z2>254 THEN 1220
1150 REM NORMAL MOVING
1160 REM CHECK FOR SPECIAL MOVE CONDITIONS
1170 GOTO 1240
1180 L2=L1:L1=Z2
1190 IF S(35)=L2 THEN S(35)=L1
1200 GOTO 9780
1210 GOTO 300
1220 Z9=FNA(1)
1230 GOTO 400
1240 REM SPECIAL ROOM DIRECTIONS
1250 REM GRATE
1260 IF NOT (L1=10 AND (D=10 OR D=5) OR L1=11 AND (D=9 OR D=3)) THEN &
     1310
1270 REM IF GRATE IS OPEN (G=0) MOVE HIM
1280 IF G THEN 1180
1290 Z9=FNA(10)
1300 GOTO 400
1310 REM CAN'T TAKE NUGGET UPSTAIRS
1320 IF NOT (L1=17 AND D=9 AND S(1)=-1) THEN 1350
1330 Z9=FNA(38)
1340 GOTO 400
1350 REM CRYSTAL BRIDGE & FISSURE
1360 IF NOT (L1=19 AND D=7 OR L1=20 AND D=3) THEN 1400
1370 IF B2 THEN 1180
1380 Z9=FNA(3)
1390 GOTO 400
1400 REM MT. KING & SNAKE
1410 IF NOT (L1=22 AND D<>3 AND D<>9) THEN 1460
1420 IF S=0 THEN 1180
1430 Z9=FNA(50)
1440 GOTO 400
1450 GOTO 400
1460 REM BEDQUILT & RANDOM DIRECTIONS
1470 IF NOT (L1=44 AND D<>3 AND D<>7) THEN 1580
1480 IF RND(0)>.5 THEN 1510
1490 Z9=FNA(52)
1500 GOTO 400
1510 RESTORE 1530
1520 REM ROOMS TO JUMP TO
1530 DATA 33,37,45,92,76
1540 FOR Z3=1 TO INT(RND(0)*5)+1
1550   READ Z2
1560 NEXT Z3
1570 GOTO 1180
1580 REM WITT'S END
1590 IF L1<>39 THEN 1680
1600 REM SHOULD WE LET HIM GET OUT
1610 IF RND(0)<.1 THEN 1650
1620 REM NO
1630 Z9=FNA(52)
1640 GOTO 400
1650 REM YES
1660 Z2=38
1670 GOTO 1180
1680 REM NARROW TUNNEL
1690 IF NOT (L1=57 OR L1=58) THEN 1770
1700 FOR Z3=1 TO T2
1710   IF Z3=10 THEN 1750
1720   IF S(Z3)<>-1 THEN 1750
1730   Z9=FNA(53)
1740   GOTO 400
1750 NEXT Z3
1760 GOTO 1180
1770 REM TROLL
1780 IF NOT (L1=60 AND D=2 OR L1=61 AND D=6) THEN 1860
1790 GOTO T+1 OF 1180,1800,1820,1840
1800 Z9=FNA(55)
1810 GOTO 400
1820 Z9=FNA(56),Z9=FNA(55)
1830 GOTO 400
1840 T=2
1850 GOTO 1180
1860 IF NOT (L1=73 AND D=1 AND D2=0) THEN 1890
1870 Z9=FNA(57)
1880 GOTO 400
1890 IF NOT (L1=82 AND S(33)=L1 AND D=1) THEN 1930
1900 REM DRAGON
1910 Z9=FNA(51)
1920 GOTO 400
1930 GOTO 1180
1940 REM OTHER COMMANDS
1950 FOR Z1=100 TO 13
1960   IF K(Z1) THEN 2090
1970 NEXT Z1
1980 REM ITEM BUT NO VERB?
1990 RESTORE 9960
2000 FOR X=1 TO 35
2010   READ D$
2020   IF K(X) THEN 940
2030 NEXT X
2040 RESTORE 2070
2050 READ (FOR X=1 TO INT(RND(0)*4)+1:B$)
2060 PRINT B$
2070 DATA "What?","I don't understand.","I can't understand that.",&
     "I don't know that word."
2080 GOTO 400
2090 Z1=Z1-100
2100 GOTO Z1 OF 2120,2220,2300,2390,2570,2640,2680,2860,2940,3001,3020,&
     3130,3690,3450,3590,3920,4160,4430,4630,4900,4950,5060,5150,5410,&
     5560,5750,5815,5920,6090,6097,6233,6270,6318,6350,6411,8970,9050,&
     9220,9490,9330
2110 GOTO 2040
2120 REM *** PLUGH ***
2130 IF L1<>7 THEN 2171
2140 IF S(35)=L1 THEN S(35)=0
2150 Z2=26
2160 GOTO 1180
2170 IF L1<>26 THEN 2200
2180 Z2=7
2190 GOTO 1180
2200 Z9=FNA(2)
2210 GOTO 400
2220 REM *** XYZZY ***
2230 IF L1<>7 THEN 2270
2240 IF S(35)=L1 THEN S(35)=0
2250 Z2=13
2260 GOTO 1180
2270 IF L1<>13 THEN 2200
2280 Z2=7
2290 GOTO 1180
2300 REM *** PLOVER *** (CAN'T BRING EMERALD WITH HIM)
2310 IF L1<>26 THEN 2360
2320 IF S(35)=L1 THEN S(35)=0
2330 IF S(10)=-1 THEN S(10)=L1
2340 Z2=58
2350 GOTO 1180
2360 IF L1<>58 THEN 2200
2370 Z2=26
2380 GOTO 1180
2390 REM *** CROSS ***
2400 IF L1<>19 THEN 2470
2410 IF B2<>0 THEN 2440
2420 Z9=FNA(3)
2430 GOTO 400
2440 D=7
2450 REM JUST GIVE NEW DIRECTION, USE MOVE ROUTINE
2460 GOTO 1070
2470 IF L1<>20 THEN 2510
2480 IF B2=0 THEN 2420
2490 D=3
2500 GOTO 1070
2510 IF L1<>60 THEN 2540
2520 D=2
2530 GOTO 1070
2540 IF L1<>61 THEN 2200
2550 D=6
2560 GOTO 1070
2570 REM *** CLIMB ***
2580 IF L1<>50 THEN 2200
2590 REM CAN HE CLIMB BEANSTALK?
2600 IF P1<2 THEN 2200
```



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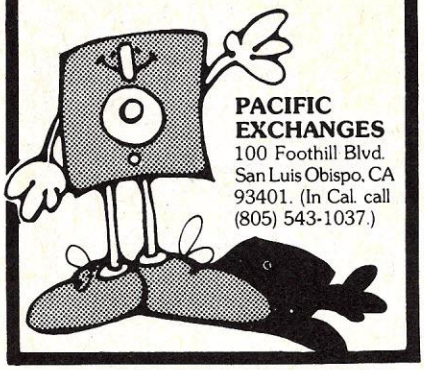

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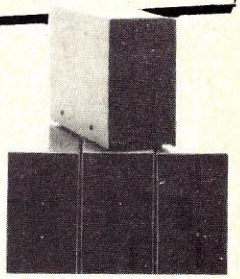

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CIRCLE 167 ON READER SERVICE CARD

```
2610 REM YES
2620 Z2=70
2630 GOTO 1180
2640 REM *** JUMP *** STRICTLY SUICIDAL
2650 IF L1()16 AND L1()19 AND L1()20 AND L1()27 THEN 2200
2660 Z9=FNA(4)
2670 GOTO 9550
2680 REM FILL
2690 IF S[21]=-1 THEN 2730
2700 B$="bottle"
2710 PRINT "You don't have the ";B$
2720 GOTO 410
2730 IF B0=0 THEN 2760
2740 Z9=FNA(5)
2750 GOTO 410
2760 IF L1()7 AND L1()8 AND L1()9 AND L1()35 AND L1()74 AND L1()81&
     THEN 2790
2770 B0=1,S[16]=-1
2780 GOTO 2840
2790 IF L1=49 THEN 2830
2800 B$="oil"
2810 PRINT "I see no ";B$;" here."
2820 GOTO 400
2830 B0=2,S[17]=-1
2840 PRINT "The bottle is now filled"
2850 GOTO 400
2860 REM *** EMPTY ***
2870 IF S[21]=-1 THEN 2890
2880 GOTO 2700
2890 REM EMPTY BOTTLE (ASSUMED FULL)
2900 S[B0+15]=0,B0=0
2910 PRINT "Emptied"
2920 GOTO 400
2930 REM *** LOOK ***
2940 IF L1<13 OR L1=58 OR (L=1 AND (S[18]=L1 OR S[18]=-1)) THEN 2970
2950 Z9=FNA(45)
2960 GOTO 400
2970 GOSUB 8050
2980 GOSUB 6680
2990 GOTO 400
3000 REM *** LIGHT ***
3010 IF S[18]=-1 THEN 3040
3020 B$="lamp"
3030 GOTO 2710
3040 L=1
3050 B$="on"
3060 PRINT "The lamp is now ";B$
3070 GOTO 2940
3080 REM *** OFF (EXTINGUISH) ***
3090 IF S[18]=-1 THEN 3110
3100 GOTO 3020
3110 L=0,B$="off"
3120 GOTO 3060
3130 REM *** ENTER ***
3140 IF L1()6 THEN 3180
3150 REM TO HOUSE
3160 D=3
3170 GOTO 1070
3180 IF L1()68 THEN 3220
3190 REM TO BARREN ROOM
3200 D=3
3210 GOTO 1070
3220 READ #4,A
3230 READ #4;(FOR X=1 TO L1,A$)
3240 FOR Z0=1 TO 10
3250   Z2=NUM(A$[Z0])
3260   IF Z2>0 AND Z2<101 THEN 1150
3270 NEXT Z0
3280 GOTO 2200
3290 REM ** LEAVE ***
3300 IF L1()7 THEN 3340
3310 REM LEAVE HOUSE
3320 D=7
3330 GOTO 1070
3340 IF L1()69 THEN 3380
3350 REM LEAVE BARREN ROOM
3360 D=7
3370 GOTO 1070
3380 READ #4,A
3390 READ #4;(FOR X=1 TO L1,A$)
3400 FOR Z0=1 TO 10
3410   Z2=NUM(A$[Z0])
3420   IF Z2>0 AND Z2<101 THEN 1150
3430 NEXT Z0
3440 GOTO 2200
3450 REM *** INVENTORY ***
3460 RESTORE 9960
3470 Z0=0
3480 PRINT "You are carrying:";
3490 FOR X=1 TO T2
3500   READ B$
3510   IF S[X]()-1 THEN 3540
3520   PRINT B$,
3530   Z0=Z0+1
3540 NEXT X
3550 IF Z0=0 THEN PRINT "nothing."
3560 PRINT
3570 GOTO 400
3580 REM
3590 REM *** GET ***
3600 REM
3610 REM
3620 RESTORE 580
3630 IF K[47] THEN 3680
3640 GOSUB 8280
3650 IF Z8>0 THEN 3680
3660 PRINT "Get what?"
3670 GOTO 2040
3680 RESTORE 9960
3690 FOR Z3=1 TO T2
3700   READ A$
3710   IF K[47] THEN 3730
3720   IF K[Z3]=0 THEN 3900
3730   IF S[Z3]()L1 THEN 3750
3740   ELSE GOTO 3790
3750   IF K[47] THEN 3900
3760   PRINT A$;" not here."
3770   GOTO 3900
3780   REM MUST CHECK NOW FOR LEGALITY OF TAKING ITEM
3790   Z8=0
3800   FOR X=1 TO T2
3810     IF S[X]=-1 THEN Z8=Z8+1
3820   NEXT X
3830   IF Z8<7 THEN 3870
3840   REM CARRYING TOO MUCH
3850   Z9=FNA(54)
3860   GOTO 410
3870   GOTO 6880
3880   S[Z3]=-1
3890   PRINT A$;":taken."
3900 NEXT Z3
3910 GOTO 400
3920 REM *** DROP ***
3930 RESTORE 580
3940 IF K[47] THEN 4000
3950 GOSUB 8280
3960 IF Z8>0 THEN 3990
3970 PRINT "Drop what?"
3980 GOTO 2040
3990 REM
4000 RESTORE 9960
4010 FOR Z3=1 TO T2
4020   READ B$
4030   IF K[47] THEN 4060
4040   IF K[Z3]()1 THEN 4140
4050   IF S[Z3]=0 THEN 4140
4060   IF S[Z3]=-1 THEN 4100
4070   IF K[47] THEN 4140
4080   PRINT "You don't have the ";B$
4090   GOTO 4140
4100   REM STILL NEED TO ELABORATE ON DROP (BIRD IN CAGE, BOTTLE)
4110   GOTO 7380
4120   PRINT B$;":dropped."
4130   S[Z3]=L1
4140 NEXT Z3
4150 GOTO 400
4160 REM ***THROW ***
4170 GOSUB 8280
4180 IF Z8>0 THEN 4210
4190 PRINT "Throw what?"
4200 GOTO 2040
4210 IF S[Z3]()-1 THEN 2710
4220 IF NOT (Z3<16 AND S[32]=L1) THEN 4260
4230 REM THROW TREASURE TO TROLL
4240 Z9=FNA(27),S[Z3]=0,T=3
4250 GOTO 400
4260 IF NOT (Z3=27 AND S[32]=L1) THEN 4300
4270 REM TRYING TO BUTCHER TROLL?
4280 Z9=FNA(26),S[27]=L1
4290 GOTO 400
4300 IF NOT (Z3=27 AND S[35]=L1) THEN 4330
4310 REM TRYING TO KILL DWARF
4320 IF RND(0)>.5 THEN 4360
4330 Z9=FNA(29)
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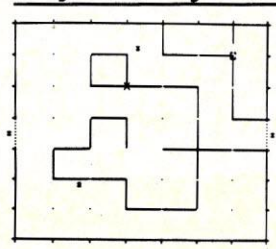

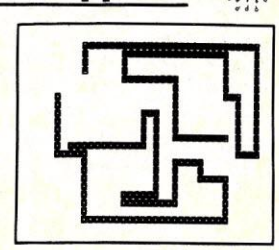

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CIRCLE 188 ON READER SERVICE CARD

```
4340 GOSUB 8650
4350 GOTO 4410
4360 Z9=FNA(30),S[35]=0
4370 GOTO 4410
4380 REM NOTHING SPECIAL,JUST DROP ITEM
4390 IF S[35]=L1 THEN GOSUB 8550
4400 PRINT "Thrown."
4410 S[Z3]=L1
4420 GOTO 400
4430 REM **** ATTACK ******
4440 GOSUB 8280
4450 IF NOT (Z3=33 AND S[Z3]=L1 AND L1=82) THEN 4520
4460 REM HE CAN KILL DRAGON
4470 Z9=FNA(68)
4480 GOTO 410
4490 IF L1<>82 THEN 2040
4500 Z9=FNA(69),S[33]=0,D1=0
4510 GOTO 400
4520 IF S[32]<>L1 THEN 4560
4530 REM TRYING TO MUNGE TROLL
4540 Z9=FNA(25)
4550 GOTO 400
4560 IF NOT (Z3=26 OR Z3>30) THEN 4600
4570 REM DANGEROUS TO ATTACK THESE
4580 Z9=FNA(70)
4590 GOTO 400
4600 REM NOTHING TO ATTACK
4610 Z9=FNA(71)
4620 GOTO 400
4630 REM *** FEED ***
4640 GOSUB 8280
4650 IF Z3<>35 THEN 4690
4660 REM CAN'T FEED DWARF!
4670 Z9=FNA(24)
4680 GOTO 400
4690 IF S[20]=-1 THEN 4720
4700 B$="FOOD"
4710 GOTO 2710
4720 IF L1=69 THEN 4760
4730 PRINT "I can't feed it."
4740 Z9=FNA(23)
4750 GOTO 400
4760 IF S[28]=L1 THEN 7600
4770 B1=1,S[20]=0
4780 Z9=FNA(6)
4790 GOTO 400
4800 REM *** WATER ***
4810 IF S[16]=-1 THEN 4840
4820 B$="water"
4830 GOTO 2710
4840 IF L1<>50 THEN 2200
4850 GOTO P1+1 OF 4860,4890,4920
4860 Z9=FNA(7)
4870 P1=1,S[16]=B0=0
4880 GOTO 400
4890 Z9=FNA(8)
4900 P1=2,S[16]=B0=0
4910 GOTO 400
4920 Z9=FNA(9)
4930 P1=0,S[16]=B0=0
4940 GOTO 400
```

```
4950 REM *** LOCK ***
4960 IF L1=10 OR L1=11 THEN 4990
4970 REM NOTHING LOCKABLE
4980 GOTO 2200
4990 IF S[19]=-1 THEN 5020
5000 B$="keys"
5010 GOTO 2710
5020 G=0
5030 Z9=FNA(10)
5040 GOTO 400
5050 S[Z3]=L1
5060 REM *** UNLOCK ***
5070 IF S[19]<>-1 THEN 5000
5080 IF L1<>10 AND L1<>11 THEN 5120
5090 G=1
5100 Z9=FNA(11)
5110 GOTO 400
5120 IF L1<>69 THEN 2200
5130 IF B1>0 THEN 5160
5140 Z9=FNA(12)
5150 GOTO 400
5160 IF C=0 THEN C=1,B1=2
5170 Z9=FNA(13)
5180 GOTO 400
5190 REM *** FREE ***
5200 IF K[31] THEN 5240
5210 REM CAN'T FREE ANYTHING BUT BIRD
5220 Z9=FNA(2)
5230 GOTO 410
5240 IF S[31]<>-1 THEN 5220
5250 S[31]=L1,B3=0
5260 PRINT "Freed."
5270 IF L1<>22 THEN 5350
5280 IF S<>1 THEN 400
5290 B$="snake"
5300 PRINT "The little bird attacks the green ";B1;" and"
5310 IF L1=82 THEN 5380
5320 PRINT "drives it off"
5330 S=0,S[34]=0
5340 GOTO 400
5350 IF L1<>82 THEN 400
5360 B$="dragon"
5370 GOTO 5300
5380 PRINT "gets burned to a crisp."
5390 S[31]=0
5400 GOTO 400
5410 REM *** WAVE ***
5420 IF NOT K[23] THEN 2200
5430 IF S[23]=-1 THEN 5460
5440 B$="rod"
5450 GOTO 2710
5460 REM   IS HERE NEAR FISSURE
5470 IF L1<>19 AND L1<>20 THEN 2200
5480 REM YES
5490 GOTO B2+1 OF 5500,5530
5500 Z9=FNA(14)
5510 B2=1
5520 GOTO 400
5530 Z9=FNA(15)
5540 B2=0
5550 GOTO 400
```

```
5560 REM *** OPEN ***
5570 GOSUB 8280
5580 IF Z3 THEN 5610
5590 PRINT "Open ";
5600 GOTO 2040
5610 IF Z3=40 THEN 5070
5620 IF S[Z3]=L1 THEN 5650
5630 PRINT "I see no ";B$;" here."
5640 GOTO 400
5650 IF Z3=24 THEN 5680
5660 PRINT "I don't know how to open a ";B$
5670 GOTO 400
5680 IF S[9]=-1 THEN 5710
5690 Z9=FNA(16)
5700 GOTO 400
5710 IF S[Z3]=0 THEN 2200
5720 REM HE'S OPENED CLAM, SO PRINT DESCRIPTION OF THIS
5730 REM PUT PEARL IN CUL-DE-SAC
5740 S[7]=43,S[24]=0,S[30]=L1,Z9=FNA(17)
5750 GOTO 400
5760 REM *** CLOSE ***
5770 GOSUB 8280
5780 IF Z3=40 THEN 4960
5790 Z9=FNA(18)
5800 GOTO 400
5810 REM  OIL
5820 IF K[17]=0 THEN 2200
5830 IF S[17]=-1 THEN 5860
5840 B$="oil"
5850 GOTO 5630
5860 IF L1<>73 THEN 2200
5870 REM IS DOOR STILL RUSTED
5880 IF D2=1 THEN 2200
5890 D2=1,S[17]=B0=0,Z9=FNA(19)
5900 GOTO 400
5910 REM *** EAT ***
5920 IF K[20] THEN 5950
5930 Z9=FNA(20)
5940 GOTO 410
5950 Z3=20
5960 GOSUB 8490
5970 IF Z5=0 THEN 410
5980 Z9=FNA(73),S[20]=0,B0=0
5990 GOTO 400
6000 REM *** DRINK ***
6010 IF K[16] THEN 6040
6020 Z9=FNA(21)
6030 GOTO 410
6040 Z3=16
6050 GOSUB 8490
6060 IF Z5=0 THEN 410
6070 Z9=FNA(22),S[17]=0,B0=0
6080 GOTO 400
6090 REM *** FEE FIE FOE FOO ***
6100 IF L1=71 THEN 6130
6110 Z9=FNA(2)
6120 GOTO 410
6130 IF S[8]<>L1 THEN 6180
6140 REM MAKE NEST VANISH
6150 Z9=FNA(79)
```

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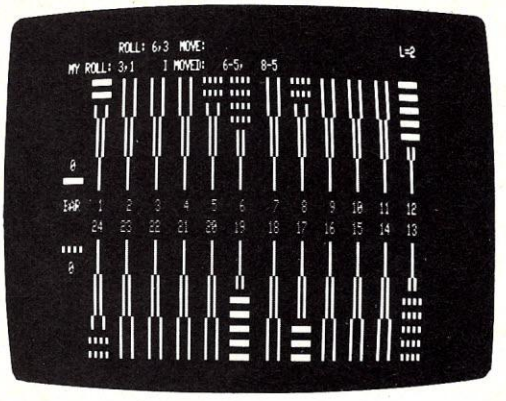
```
6160 S[8]=0
6170 GOTO 400
6180 IF S[8]=0 THEN 6110
6190 S[8]=L1
6200 REM MAKE NEST RE-APPEAR
6210 Z9=FNA(81)
6220 GOTO 400
6230 REM *** SHORT ***
6240 PRINT "Short descriptions"
6250 D0=0
6260 GOTO 400
6270 REM *** LONG ***
6280 PRINT "Long descriptions"
6290 D0=1
6300 GOTO 400
6310 REM *** BRIEF ***
6320 PRINT "OK, I'll only describe the room in detail the first time."
6330 D0=2
6340 GOTO 400
6350 REM *** QUIT ***
6360 PRINT "Save game";
6370 GOSUB 9860
6380 IF Z0 THEN 8970
6390 ELSE GOTO 9750
6400 REM *** SCORE ***
6410 GOSUB 6430
6420 GOTO 400
6430 REM   PRINT OUT SCORE DATA
6440 GOSUB 6510
6450 PRINT "Your score is now ";S0;"if"13"You have explored";(Z9/T1)*T1&
     ;"% of the cave."
6460 RESTORE 6470
6470 DATA "beginner","novice","experienced","advanced","expert"
6480 READ (FOR Z0=0 TO INT((S0-1)/100).D$)
6490 PRINT "That makes you a ";D$;" adventurer."
6500 RETURN
6510 REM COMPUTE CURRENT SCORE
6520 RESTORE 230
6530 Z9=S0=0
6540 FOR Z0=1 TO 15
6550   READ Z1
6560   IF Z1=0 THEN 6590
6570   IF V[Z1] THEN S0=S0+4*O[Z0]
6580   IF S[Z0]=7 THEN S0=S0+4*O[Z0]
6590 NEXT Z0
6600 S0=S0+(10*(G=1))+(20*(S=0))+(30*(D1=0))+(30*(L1=0))+(20*(B1=2))+(20&
     *(B2=1))+(20*(P1=2))+(20*(D2=1))+(20*(C=1))
6610 FOR Z0=1 TO T1
6620   IF V[Z0] THEN S0=S0+1,Z9=Z9+1
6630 NEXT Z0
6640 RETURN
6650 REM
6660 REM LIST ITEMS AT LOCATION L1
6670 REM
6680 READ #1,1
6690 FOR Z1=1 TO T2
6700   READ #1;A$
6710   IF S[Z1]=L1 THEN PRINT A$
6720 NEXT Z1
6730 REM CHECK FOR DWARF,PIRATE
6740 GOSUB 8560
6750 GOSUB 8800
6760 PRINT
6770 RETURN
6780 REM
6790 REM PRINT SHORT ROOM DESCRIPTION
6800 REM
6810 READ #2,L
6820 FOR Z1=1 TO L1
6830   READ #2;A$
6840 NEXT Z1
6850 V[L]=1
6860 PRINT A$
6870 RETURN
6880 REM SPECIAL "GET"S
6890 IF NOT (Z3=24 OR Z3=30 OR Z3)31) THEN 6930
6900 REM CAN'T GET THESE FOR SOME REASON
6910 Z9=FNA(61)
6920 GOTO 400
6930 IF NOT (Z3=12 AND C=0) THEN 6970
6940 REM CHAIN
6950 Z9=FNA(58)
6960 GOTO 3900
6970 REM BEAR-IS HE FED? UNLOCKED?
6980 IF NOT (Z3=26 AND B1()2) THEN 7010
6990 Z9=FNA(61)
7000 GOTO 3900
7010 IF NOT (Z3=14 AND D1=1) THEN 7050
7020 REM DRAGON & RUG
7030 Z9=FNA(59)
7040 GOTO 3900
7050 IF NOT (Z3=16 OR Z3=17) THEN 7090
7060 REM OIL & WATER-DO SAME AS FILL
7070 PRINT "Why not say 'fill'?"
7080 GOTO 3900
7090 IF NOT (Z3=22 AND B3) THEN 7140
7100 REM TAKE BIRD, SINCE IT'S IN CAGE
7110 S[31]=-1
7120 PRINT "Bird and ";
7130 GOTO 3880
7140 IF Z3()31 THEN 7210
7150 REM GETTING BIRD
7160 IF B3()1 THEN 7210
7170 REM TAKE CAGE, SINCE BIRD IS IN IT
7180 PRINT "Cage and ";
7190 S[22]=-1
7200 GOTO 3880
7210 IF S[22]=-1 THEN 7240
7220 B$="cage"
7230 GOTO 2810
7240 IF S[23]=-1 THEN 7260
7250 REM OK TO TAKE BIRD
7260 S[31]=-1,B3=1
7270 GOTO 3890
7280 REM ROD SCARES BIRD
7290 Z9=FNA(37)
7300 GOTO 3900
7310 REM BOTTLE FULL? IF SO, GET CONTENTS
7320 IF NOT (Z3=21 AND B0) THEN 7360
7330 PRINT "Contents and the ";
7340 S[B0+15]=-1
7350 GOTO 3880
7360 GOTO 3880
7370 REM SPECIAL "DROP"
7380 IF Z3()31 THEN 7440
7390 REM BIRD IN CAGE
7400 S[31]=L1,S[22]=L1,B3=1
7410 IF Z3=31 THEN PRINT "Cage and ";
7420 IF Z3=22 THEN PRINT "Bird and ";
7430 GOTO 4120
7440 IF Z3=22 AND B3 THEN 7400
7450 IF Z3()21 THEN 7520
7460 REM BOTTLE
7470 IF B0=0 THEN 4120
7480 REM BOTTLE IS FULL, SO DROP CONTENTS TOO
7490 PRINT "Contents and ";
7500 S[15+B0]=L1
7510 GOTO 4120
7520 IF NOT (Z3=16 OR Z3=17) THEN 7550
7530 PRINT "Try saying 'empty'"
7540 GOTO 4140
7550 IF Z3()6 THEN 4120
7560 IF S[28]=L1 THEN 7600
7570 REM GOODBYE, FRAGILE VASE!
7580 Z9=FNA(43),S[28]=0,S[29]=L1
7590 GOTO 400
7600 Z9=FNA(60)
7610 GOTO 4120
7620 DEF FNA(Z5)
7630   REM PRINT MESSAGE
7640   IF Z5=2 THEN Z5=2+INT(RND(0)*5)/10
7650   IF Z5=61 THEN Z5=Z5+INT(RND(0)*5)/10
7660   READ #3,L
7670   ON LND #3 THEN 7760
7680   READ #3;B$
7690   IF NOT (POS(B$,"$")) THEN 7680
7700   CONVERT B$[2] TO Z4,7680
7710   IF Z4()Z5 THEN 7680
7720   READ #3;B$
7730   IF B$[1,1]="$" THEN RETURN 0
7740   PRINT B$
7750   GOTO 7720
7760   PRINT "NO DESC. #";Z5;" IN FILE 4"
7770   RETURN 0
7780 FNEND
7790 END
7800 REM
7810 REM  SITUATION DESCRIPTIONS
7820 REM
7830 REM GRATE
7840 IF L1=10 OR L1=14 THEN Z9=FNA(3*10)
7850 REM CRYSTAL BRIDGE
7860 IF (L1=9 OR L1=20) AND B2 THEN Z9=FNA(14)
7870 REM PLUGH NOISE
```

MICRO-BACKGAMMON 1.5



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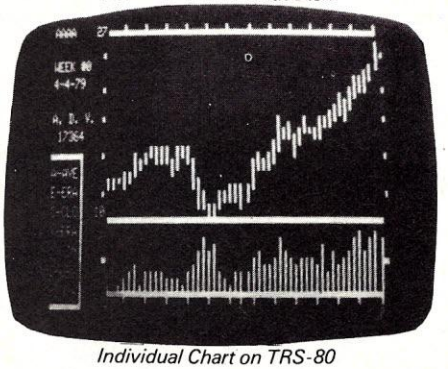

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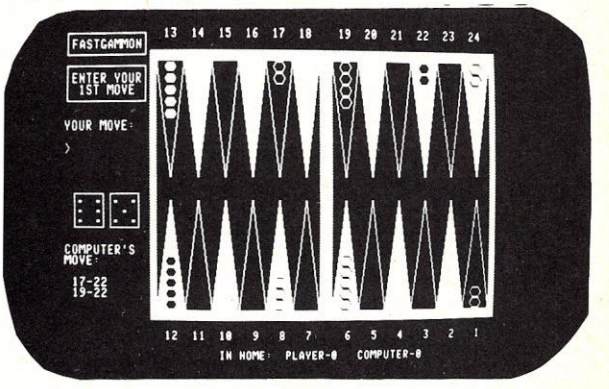
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YOUR MOVE:
COMPUTER'S MOVE:
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19-22
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12 11 10 9 8 7 6 5 4 3 2 1
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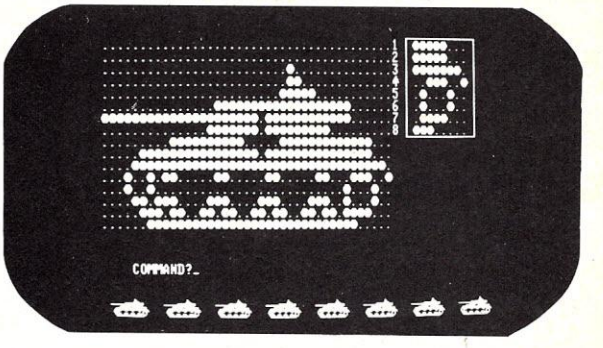

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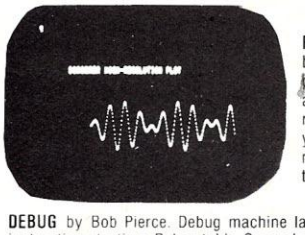

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CIRCLE 191 ON READER SERVICE CARD

```
7880 IF L1=26 AND RND(0)).3 THEN Z9=FNA(41)
7890 REM IRON DOOR
7900 IF L1=73 AND D2=0 THEN Z9=FNA(57)
7910 REM TROLL
7920 IF L1=60 OR L1=61 AND T=1 THEN Z9=FNA(63)
7930 REM BEAR
7940 IF L1=69 AND B1=0 THEN Z9=FNA(64)
7950 IF L1=69 AND B1=1 THEN Z9=FNA(66)
7960 REM PLANT IN PIT
7970 IF L1=48 OR L1=50 THEN Z9=FNA(47+P1)
7980 RETURN
7990 REM
8000 REM  PRINT LONG ROOM DESCRIPTION FROM "amessage" FILE
8010 REM  DESCRIPTION IS NORMALLY L1+200 EXCEPT FOR
8020 REM  MAZE OR FOREST
8030 REM SET V(L1)=1 SO AS NOT TO REPEAT LONG DESC(BRIEF MODE
8040 V[L1]=1
8050 IF L1>4 THEN 8080
8060 Z9=FNA(200)
8070 GOTO 8130
8080 IF.NOT (L1)88 AND L1(98 OR L1=99) THEN 8110
8090 Z9=FNA(288)
8100 GOTO 8130
8110 REM NORMAL DESCRIPTION
8120 Z9=FNA(200+L1)
8130 RETURN
8140 REM
8150 REM BRIEF DESCRIPTION (ONLY PRINT LONG DESCRIPTION
8160 REM IF HE HASN'T BEEN AT L1 BEFORE)
8170 REM
8180 REM ALWAYS GIVE LONG DESCRIPTION FOR FOREST AND MAZE
8190 IF L1(5 OR (L1)88 AND L1(98) OR L1=99 THEN 8220
8200 IF V[L1] THEN 6780
8210 REM HE HASN'T SEEN THIS ROOM, SO GIVE A LONG DESC.
8220 V[L1]=1
8230 GOTO 7990
8240 REM
8250 REM  FETCH FIRST ITEM CODE IN K(1 TO T2)
8260 REM  Z8=TOTAL # OF ITEMS FOUND IN LIST
8270 REM  Z3=ITEM CODE FIRST FOUND
8280 Z8=0,Z3=0
8290 RESTORE 9960
8300 FOR Z5=1 TO 45
8310   READ B$
8320   IF K[Z5]=0 THEN 8360
8330   Z8=Z8+1
8340   D$=B$
8350   IF K[Z5] AND Z8=1 THEN Z3=Z5
8360 NEXT Z5
8370 B$=D$
8380 RETURN
8390 REM FIND FIRST ITEM AT ROOM
8400 RESTORE 9960
8410 FOR Z1=1 TO 47
8420   IF K[Z1] THEN RETURN
8430   READ D$
8440 NEXT Z1
8450 RETURN
8460 REM
8470 REM      MAKE SURE HE'S CARRYING ITEM # Z3
8480 REM
```

```
8490 IF S[Z3]=-1 THEN 8530
8500 PRINT "You don't have the ";A$
8510 Z5=0
8520 RETURN
8530 Z5=1
8540 RETURN
8550 REM *** DWARF ***
8560 IF D3()0 THEN 8640
8570 REM SHOULD DWARF GIVE AWAY AXE
8580 IF L1(13 THEN RETURN
8590 IF RND(0)).05 THEN RETURN
8600 REM GIVE AWAY AXE
8610 Z9=FNA(80)
8620 S[27]=L1,D3=1
8630 RETURN
8640 REM SHOULD DWARF ATTACK?
8650 IF L1(13 THEN RETURN
8660 IF S[35]()L1 THEN 8770
8670 IF RND(0)).5 THEN RETURN
8680 REM YES!
8690 Z9=FNA(32)
8700 REM DOES THE KNIFE KILL PLAYER
8710 IF RND(0)).25 THEN 8750
8720 REM YES
8730 PRINT "It gets you!"
8740 GOTO 9540
8750 PRINT "It misses!"
8760 RETURN
8770 REM SHOULD WE PUT A DWARF HERE?
8780 IF RND(0)(.2 THEN S[35]=L1
8790 RETURN
8800 REM *** PIRATE ***
8810 REM FIRST, DOES HE HAVE ANYTHING WORTH STEALING
8820 Z3=0
8830 IF L1(13 THEN RETURN
8840 FOR X=1 TO 15
8850   IF S[X]=-1 THEN Z3=Z3+1
8860 NEXT X
8870 IF Z3(INT(RND(0)*4)+1 THEN RETURN
8880 REM SHOULD WE RIP OFF HIS VALAUBLES?
8890 IF RND(0)(.05 THEN 8920
8900 Z9=FNA(34)
8910 RETURN
8920 Z9=FNA(33)
8930 FOR X=1 TO 15
8940   IF S[X]=-1 THEN S[X]=100
8950 NEXT X
8960 RETURN
8970 REM ***** SAVE GAME ******
8980 INPUT "What do you want to call the save file?",A$
8990 CREATE N,A$,8
9000 IF N()0 THEN PRINT "File ";A$;" not created"
9010 IF N()0 THEN 410
9020 ASSIGN A$,5,R
9030 PRINT #5;T1,T2,T3,L1,L2,G,B0,S,D1,D2,D0,T,B1,B2,P1,D,L,C,D3,B3,R0
9040 MAT PRINT #5;S,V
9050 PRINT "Game saved"
9060 IF K[143] THEN 9750
9070 GOTO 410
9080 REM ***** LOAD OLD GAME *****
9090 IF C0=0 THEN 9120
9100 PRINT "You already have a loaded game!"
9110 GOTO 410
9120 INPUT "Save file name?",A$
9130 ASSIGN A$,5,R
9140 IF R()3 THEN 9170
9150 PRINT "Unable to use file ";A$
9160 GOTO 410
9170 READ #5;T1,T2,T3,L1,L2,G,B0,S,D1,D2,D0,T,B1,
     B2,P1,D,L,C,D3,B3,R0
9180 MAT READ #5;S,V
9190 PRINT "Starting new game..."
9200 C0=1
9210 GOTO 300
9220 REM *** READ THE MAGAZINE ***
9230 GOSUB 8280
9240 IF Z3=25 THEN 9270
9250 Z9=FNA(74)
9260 GOTO 410
9270 IF S[25]=-1 THEN 9300
9280 B$="magazine"
9290 GOTO 2710
9300 REM OK, LET HIM READ IT
9310 Z9=FNA(403)
9320 GOTO 400
9330 REM *** BUG ***
9340 ASSIGN *,5
9350 ASSIGN "BUG",5,R
9360 IF R()0 THEN 9150
9370 ON END #1 THEN 9520
9380 ADVANCE #5;9999,R
9390 INPUT "Your name:",A$
9400 A$=A$+DAT$(1,2)
9410 PRINT #5;A$
9420 PRINT "Enter you gripe in up to five lines
     (hit return to quit):"
9430 FOR Z0=1 TO 5
9440   PRINT Z0,
9450   LINPUT A$
9460   IF A$="" THEN 9490
9470   PRINT #5;A$
9480 NEXT Z0
9490 PRINT "Message recorded. Thank you!"
9500 ASSIGN *,5
9510 GOTO 410
9520 PRINT "End of file error."
9530 GOTO 410
9540 REM REINCARNATE HIM
```

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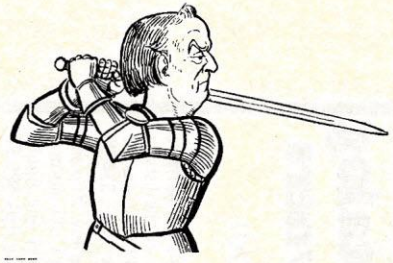
CIRCLE 199 ON READER SERVICE CARD

```
9550 R0=K0+1
9560 GOTO K0 OF 9580,9610,9740
9570 REM ASK HIM IF HE WANTS TO BE REINCARNATED
9580 Z9=FNA(75)
9590 GOSUB 9860
9600 GOTO 9630
9610 Z9=FNA(77)
9620 GOTO 9580
9630 IF Z0=0 THEN 9750
9640 Z9=FNA(76)
9650 REM PUT HIM BACK IN HOUSE, REARRANGE HIS STUFF
9660 S[18]=7,L=0
9670 FOR X=1 TO T2
9680   IF S[X]=-1 THEN S[X]=L1
9690 NEXT X
9700 REM WE'VE PUT THE LAMP IN HOUSE AND OTHER ITEMS WHERE HE DIED
9710 L1=INT(RND(0)*4)+1,L2=L1
9720 GOTO 320
9730 REM THIRD DEATH--END OF GAME
9740 Z9=FNA(78)
9750 PRINT "Oh well..."
9760 GOSUB 6430
9770 STOP
9780 REM  **** PITS ***
9790 IF L1<13 OR (L=1 AND (S[18]=-1 OR S[18]=L1)) THEN 1210
9800 REM IS HE GOING TO FALL INTO A PIT?
9810 IF L1=16 OR L1=17 OR L1=19 OR L1=20 OR L1=25 OR L1=47 OR L1=48 OR &
     L1=59 OR L1=60 OR L1=61 OR L1=75 OR L1=76 OR L1=98 THEN 9840
9820 GOTO 1210
9830 REM HE FELL IN!
9840 Z9=FNA(44)
9850 GOTO 9540
9860 REM ***   SEEK A "YES" OR "NO"
9870 INPUT A$
9880 A$=UPS$(A$[1,1])
9890 IF A$<>"Y" AND A$<>"N" THEN 9930
9900 IF A$="Y" THEN Z0=1
9910 IF A$="N" THEN Z0=0
9920 RETURN
9930 PRINT "Yes or No-";
9940 GOTO 9870
9950 REM      ----- SHORT NAMES FOR STUFF ---
9960 DATA "large gold nugget","bars of silver","precious jewelry",&
     "many coins","several diamonds","fragile ming vase",&
     "glistening pearl","nest of golden eggs","jewel-encrusted trident"&
     ,"egg-sized emerald","platinum pyramid","golden chain",&
     "rare spices","persian rug","treasure chest","water","oil",&
     "brass lamp","keys","food","bottle","wicker cage",&
     "3-foot black rod","clam","magazine","bear","axe","velvet pillow",&
     "shards of pottery","oyster","bird","troll","dragon","snake",&
     "dwarf","rock","stairs","house","grate","stream","room","bridge",&
     "pit","volcano","road"
```




```
Welcome to adventure!  Would you like instructions?

 YES
Somewhere nearby is Colossal Cave, where many have found gold
and treasure, though it is rumoured that some who enter are
never seen again.  I will be your eyes and hands. Direct me with
commands such as get,take, or look. Since you need to move around,
you must usually enter compass directions (N,NE,L,SE,S,SW,W,NW, or
up or down), although you may sometimes use more vague verbs with
which to move.  I know of several objects in this game, such as
a lamp and a bottle. I also know of special objects in the cave.
Some of these objects have side effects, ie there is a rod in the
cave that scares a little bird.
-------------------------------------------------------------------
The object of this game is to gather as many treasures as you can
and put them back in the house.  You also run the risk of getting
robbed or killed by some rather unfriendly inhabitants of the cave.
-------------------------------------------------------------------
There are some useful commands that you should know about:
--- Brief, Long, and Short-these commands control the amount of
--- detail you get in descriptions.
--- Look (or L)-gives a detailed description of your surroundings.
--- Inventory ( or I)-tells you what you are carrying.
--- Quit, Stop, or End--these are self-explanatory.
--- Save-by typing this, you may save your game and continue it
--- at a later time.
--- Continue- lets you continue an old game.
--- Score- tells you how well you're doing.

Other helpful functions include:
* multiple commands on one input line, ie:
"Go south. Get car, keys. Start car." (example only)
-------------------------------------------------------------------
"Adventure" is a version of the game created by Willy Crowther and
Don Woods at M.I.T.
-------------------------------------------------------------------
You are in a forest, with trees all around you.

>GO SOUTH
You are in a forest, with trees all around you.

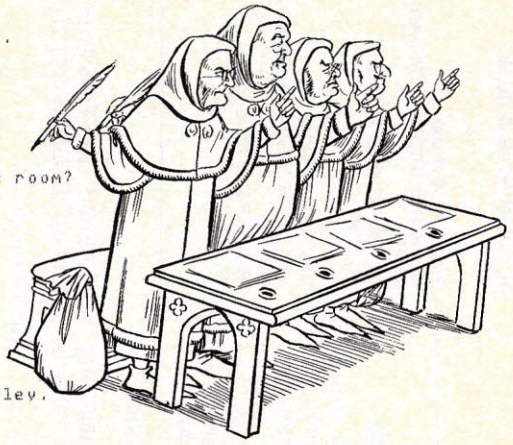
>GO EAST
You are in a valley in the forest beside a stream
tumbling along a rocky bed.

>FOLLOW STREAM
What do you want to do with the stream?
>FOLLOW IT
I don't know that word.
>GO NORTH
You are standing at the end of a road before a small
brick building.  Around you is a forest.  A small stream
flows out of the building and down a gully.

>ENTER HOUSE
What do you want to do with the house?
>GO IN
You are inside a building, a well house for a large
spring.
```

There is a bottle of water here.
There is a brass lantern here.
There is a set of keys here.
There is food here.
There is a glass bottle here.

>GET EVERYTHING IN ROOM
What do you want to do with the room?
>TAKE EVERYTHING
Why not say 'fill'?
brass lamp:taken.
keys:taken.
food:taken.
Contents and the bottle:taken.
>LEAVE
You're at road near house.



>S
You're beside a stream in a valley.

>S
At your feet all the water of the stream splashes into
a 2-inch slit in the rock. Downstream the streambed is bare rock.

>S
You are in a 20 foot depression floored with bare dirt.
Set into the dirt is a strong steel grate mounted in concrete.
A dry streambed leads into the depression.

The grate is locked.
>INVENTORY
You are carrying:water brass lamp keys food
bottle
>OPEN GRATE
What do you want to do with the grate?
>OPEN
Open I can't understand that!
>UNLOCK IT
The grate is unlocked.
>ENTE!!!
DOWN
You are in a small chamber beneath a 3x3 steel grate to the surface.
A low crawl over cobbles leads inward to the west.

The grate is unlocked.
>SAV!!!
QUITE
I can't understand that!
>QUIT
Save game?YES
What do you want to call the save file?CAVESAVE
Game saved
Oh well...
Your score is now 1%
You have explored 7. % of the cave.
That makes you a beginner adventurer.

Starting new game...
You are below the grate.

The grate is unlocked.
>I
You are carrying:water brass lamp keys food
bottle
>LOOK
You are in a small chamber beneath a 3x3 steel grate to the surface.
A low crawl over cobbles leads inward to the west.

>WEST
You are crawling over cobbles in a low passage. There is a dim light
at the east end of the passage.
There is a small wicker cage here.

>TAKE CAGE
wicker cage:taken.
>W
It is now pitch dark. If you proceed you may fall into a pit.
>LIGHT LAMP
The lamp is now on
You are in a debris room filled with stuff washed in from the surface.
A low wide passage with cobbles becomes plugged with mud and debris
here, but an awkward canyon leads upward and west. A note on the wall
says "Magic Word Xyzzy".
There is a 3-foot black rod here.

>GET ROD, GO UP
3-foot black rod:taken.
Your are in an awkward sloping east/west canyon.

>U
You are in a splendid chamber thirty feet high. The walls are frozen
rivers of orange stone. An awkward canyon and a good passage exit
from east and west sides of the chamber.
There is a little bird here.

>CATCH BIRD
Your load is too heavy. You'd best take inventory and drop
something first.
>INVENTORY
You are carrying:water brass lamp keys food
bottle wicker cage 3-foot black rod
>DROP ROD, CATCH BIRD
3-foot black rod:dropped.
bird:taken.

short programs.....

Double Subscripts Become Single

If you have a version of BASIC which does not allow double subscripts, have you looked wistfully at all the interesting games and programs that contain lines like:

100 A(I,J) = I + J/10...?

Well, the situation really is far from hopeless. As a simple example, suppose you wanted to create and print a table of numbers. You want the table to have five rows and seven columns, and each entry in the table is to be a decimal number with the row number on the left of the decimal point and the column number on the right. Here is one way to do it with double subscripts:

```
20 FOR I=1 TO 5
30 FOR J=1 TO 7
40 A(I,J)=I+J/10
50 PRINT A(I,J);
60 NEXT J
70 PRINT
80 NEXT I
90 END
run
 1.1  1.2  1.3  1.4  1.5  1.6  1.7
 2.1  2.2  2.3  2.4  2.5  2.6  2.7
 3.1  3.2  3.3  3.4  3.5  3.6  3.7
 4.1  4.2  4.3  4.4  4.5  4.6  4.7
 5.1  5.2  5.3  5.4  5.5  5.6  5.7
```

Can we achieve the same result without the use of double subscripts? Happily, the answer is yes. Add the following line:

35 N = 7*(I-1) + J

and change lines 40 and 50 to:

40 A(N) = I + J/10
50 PRINT A(N);

The secret is at line 35. In general, to imitate the variable A(I,J), use A(C*(I-1) + J) where C is the number of **columns** in your array.

It's that simple.

With this technique, for instance, I have been able to translate Gregory Yob's "HUNT THE WUMPUS" into Radio Shack's Level I BASIC, which allows only single subscripts.

Well, what are you waiting for? Get out those back issues of **Creative Computing** that had all the games you **thought** you couldn't program.

Now you can.

James Garon
Math Dept.
Calif. State University
Fullerton, CA 92634

Prime Factors

Here's a short prime factoring program submitted by J. Jeffery. Operation of the program is explained in the Remark statements.

```
100  PRINT "PRIME FACTORING PROGRAM"
110  PRINT "INPUT POSITIVE INTEGER TO BE FACTORED:"
120  INPUT X1
130  PRINT "THE PRIME FACTORS ARE AS FOLLOWS:"
140  REM:    X2 REPRESENTS THE DIVISORS USED TO TEST NUMBER.
150  X2=2
160  GOSUB 300
170  X2=3
180  GOSUB 300
190  REM:   LINES 170 THROUGH 230 GENERATE ALL PRIMES REQUIRED
200  REM:   AS DIVISORS.  ALSO, SOME COMPOSITES ARE GENERATED,
210  REM:   BUT THE EQUATIONS REDUCE THE NUMBER CONSIDERABLY.
220  FOR N=0 TO SQR(X1)/6
230  X2=6*N+5
240  GOSUB 300
250  X2=6*N+7
260  GOSUB 300
270  NEXT N
280  GOTO 380
290  REM:   SUBROUTINE TESTS DIVISIBILITY.
300  X4=INT(X1/X2)*X2
310  X4=INT(X1/X2)*X2
320  IF X4#X1 THEN 370
330  PRINT X2;
340  X1=X1/X2
350  IF X1=1 THEN 390
360  GOTO 310
370  RETURN
380  PRINT X1
390  END
```

```
PRIME FACTORINGROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?56
THE PRIME FACTORS ARE AS FOLLOWS:
 2    2    2    7

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?999991
THE PRIME FACTORS ARE AS FOLLOWS:
 17    59    997

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?999919
THE PRIME FACTORS ARE AS FOLLOWS:
 991   1009

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?8191
THE PRIME FACTORS ARE AS FOLLOWS:
 8191

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?510510
THE PRIME FACTORS ARE AS FOLLOWS:
 2    3    5    7    11    13    17

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?999199
THE PRIME FACTORS ARE AS FOLLOWS:
 999199.

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?999919
THE PRIME FACTORS ARE AS FOLLOWS:
 991   1009

PRIME FACTORING PROGRAM
INPUT POSITIVE INTEGER TO BE FACTORED:
?9819
THE PRIME FACTORS ARE AS FOLLOWS:
 3    3    1091
```

Indefinite Articles

When I was typing ANIMAL *(from BASIC Computer Games)* into my system, I noticed that the program did not provide for the proper article preceding a noun. This user defined function takes as its argument any word, and catenates "A" or "AN" as appropriate.

Here it is in two different BASICs:

```
DEF FNA(X$)="A"+LEFT$("N",INSTR(1,"aeiouAEIOU",LEFT(X$,1)))+" "+X$
DEF FNA(X$)="A"+SEG$("N",1,POS("aeiouAEIOU",SEG$(X$,1,1),1))+" "+X$
```

So the result of
PRINT FNA("HAWK"), FNA("OWL")
would be:
A HAWK AN OWL

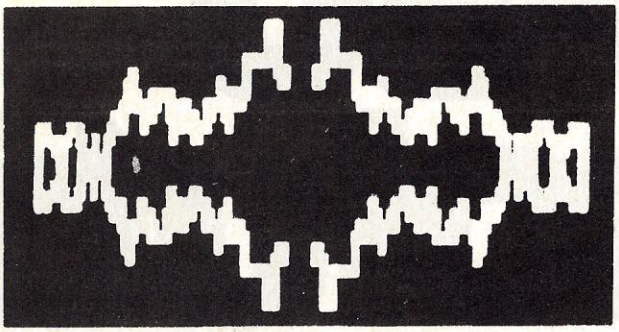
Brian Hammerstein
5700 Arlington Avenue
Riverdale, NY 10471

```
10 DIM A(35)
20 FOR I=1 TO 5
30 FOR J=1 TO 7
35 N = 7*(I-1)+J
40 A(N) = I + J/10
50 PRINT A(N);
60 NEXT J
70 PRINT
80 NEXT I
90 END

run
 1.1  1.2  1.3  1.4  1.5  1.6  1.7
 2.1  2.2  2.3  2.4  2.5  2.6  2.7
 3.1  3.2  3.3  3.4  3.5  3.6  3.7
 4.1  4.2  4.3  4.4  4.5  4.6  4.7
 5.1  5.2  5.3  5.4  5.5  5.6  5.7
```

short programs.....

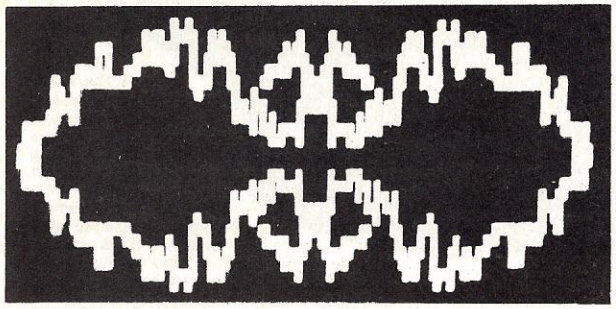
Rorschach II



This program is written for the TRS-80, Level I. It simulates random Rorschach-like patterns. The program will continue to run with no user input. To stop, use the BREAK key.

```
100 CLS
150 X=1:Y=23
200 C=200
300 F.B=1 TO C
400 A(B)=RND(3)
500 N.B
600 F.B=1 TO C
700 ON(A(B))G.1000,2000,3000
800 IF(Y<1)+(Y>47)T.950
820 S.(X,Y)
830 S.(127-X,Y)
850 S.(X,47-Y)
870 S.(127-X,47-Y)
900 N.B
950 F.U=1 TO 1000:N.U:CLS
970 G.150
1000 X=X+1
1100 G.800
2000 Y=Y+1
2100 G.800
3000 Y=Y-1
3100 G.800
```

Reprinted from Micronews, January 1979, published by the Cuatro Computer Club; Ave Los Pinos EDF, Airosa #5, La Florida—Caracas, VENEZUELA.



Date Conversion

This short routine takes a beginning date and ending date, and calculates the elapsed time involved. The advantage of this routine is that it allows the dates to be entered in the standard MM/DD/YY format. Entered as strings, the numerical values are then extracted using string handling routines.

This routine can be very useful in a program where elapsed time is used as a factor in calculations. The interest calculation program shows an example of how this routine can be used in a program. This is only one example of how the routine can be used.

The calculations are based on 30 day months and 360 day years, as are most business oriented tasks such as the interest example.

Joe Ligori
2660 W. Ball Rd. #91
Anaheim, CA. 92804

```
LIST
10 '            ===== DATE CONVERSION =====
20 '            ---------------------------
30 PRINT : PRINT : PRINT
40 PRINT "ENTER BEGINNING DATE (MM/DD/YY) : ";: INPUT A$
50 PRINT: PRINT "ENTER ENDING DATE (MM/DD/YY) : ";: INPUT B$
60 PRINT: M=VAL(LEFT$(B$,2))-VAL(LEFT$(A$,2))
70 D=VAL(MID$(B$,4,2))-VAL(MID$(A$,4,2))
80 Y=VAL(RIGHT$(B$,2))-VAL(RIGHT$(A$,2))
90 IF M<0 THEN M=12+M: Y=Y-1
100 IF D<0 THEN D=30+D: M=M-1: IF M<0 THEN Y=Y-1: M=M+12
110 PRINT "MONTHS :";TAB(20);M
120 PRINT "DAYS   :";TAB(20);D
130 PRINT "YEARS  :";TAB(20);Y
140 END

ENTER BEGINNING DATE (MM/DD/YY) : ? 10/08/77

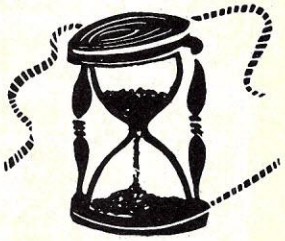
ENTER ENDING DATE (MM/DD/YY) : ? 03/04/78

MONTHS :            4
DAYS   :            26
YEARS  :            0

ENTER BEGINNING DATE (MM/DD/YY) : ? 08/28/76

ENTER ENDING DATE (MM/DD/YY) : ? 10/25/78

MONTHS :            1
DAYS   :            27
YEARS  :            2
```



```
RUN

ENTER BEGINNING DATE (MM/DD/YY) : ? 04/22/75

ENTER ENDING DATE (MM/DD/YY) : ? 10/24/78

ENTER AMOUNT : ? 1000

ENTER INTEREST RATE : ? 7


                $ 1000    AT   7 %
        FROM :  04/22/75  TO   10/24/78

              AMOUNT OF INTEREST
                  $245.39
```

```
LIST
10 '            ==== INTEREST CALCULATION ====
20 '                        WITH
30 '            ====== DATE CONVERSION ======
40 '            ------------------------------
50 PRINT : PRINT : PRINT
60 PRINT "ENTER BEGINNING DATE (MM/DD/YY) : ";: INPUT A$
70 PRINT : PRINT "ENTER ENDING DATE (MM/DD/YY) : ";: INPUT B$
80 PRINT : INPUT "ENTER AMOUNT : ";A
90 PRINT : INPUT "ENTER INTEREST RATE : ";IT
100 PRINT: PRINT: PRINT: PRINT
110 IF IT>1 THEN IT=IT/100
120 M=VAL(LEFT$(B$,2))-VAL(LEFT$(A$,2))
130 D=VAL(MID$(B$,4,2))-VAL(MID$(A$,4,2))
140 Y=VAL(RIGHT$(B$,2))-VAL(RIGHT$(A$,2))
150 IF M<0 THEN M=12+M: Y=Y-1
160 IF D<0 THEN D=30+D: M=M-1: IF M<0 THEN Y=Y-1: M=M+12
170 PRINT TAB(20);"$";A;"   AT  ";(IT*100);"%"
180 PRINT TAB(10);"FROM :   ";A$;"   TO   ";B$
190 DAYS=D+(Y*360)+(M*30)
200 RATE=(IT*A)/360
210 AMT = DAYS * RATE
220 PRINT : PRINT TAB(20)"AMOUNT OF INTEREST"
230 PRINT TAB(22) USING "$$####.##";AMT
240 END
```

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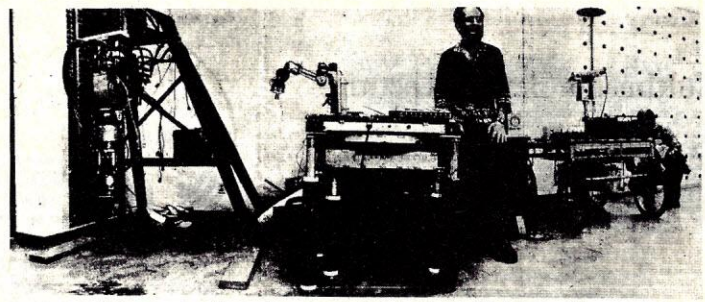
STANFORD SCIENTISTS "HOUSEBREAK" THE COMPUTER

The care and feeding of programmers is not what the computers at Stanford University's Artificial Intelligence Laboratory are all about. It just seems that way sometimes.

On a recent afternoon, Lester Earnest studied the food on display in a vending machine and then typed his choice onto the computer terminal next to it. The appropriate door unlocked, and he pulled out an empanada. No money changed hands. Earnest, who is associate director of the lab, will be billed at the end of the month.

In many respects there seems little that the machine can't do for the scientists at AI Lab. The computer system handles their correspondence, corrects their spelling, keeps them up to date on news stories, plays games with them, reminds them of business appointments and of their children's birthdays. And what computers do for them, the rest of us may experience shortly.

The Stanford scientists are working on the protocols for a national computer network that would use telephone lines to supply such services to home or office computers. Called Dialnet, the project is financed by the National Science Foundation.



Lester Earnest, associate director of Stanford's Artificial Intelligence Lab, with robot helpers used in mechanical assembly work. (Photo by Christopher Springmann).

Millions of Americans will eventually have an enormous variety of services brought to their homes via a typewriter-like keyboard and a TV screen. It is predicted that within the next five to twenty years, personal computers will be as common in American homes as TV sets are now.

Up to now, home computers have largely been used for playing games, for filing favorite recipes or income tax information, and for other self-contained activities. But Earnest suggests that the computer's real value will be to bring the world inside, to serve as a "porthole into external services. That's not here yet for most people," he says.

At Stanford, much of what will one day be available to the average consumer is already at hand. For example, the AI Lab is hooked up, via phone line, to the Associated Press and New York Times wire services. AI scientists have access to news stories as they break. Earnest is enthusiastic about the possibility of writing instant letters to the editor, of talking back to the source. Home readers could ask for more information on a subject while reporters add to and change their stories. News articles may also be stored and indexed for research purposes, and consumers should eventually be able to buy access to reference libraries.

The computer also offers the most personalized service. Both business and personal messages are printed out automatically whenever the scientist asks for them. There is a feature in the programs that will remind a graduate student of a class or dentist appointment. Many of the programmers keep lists of important telephone numbers or their appointment calenders on the computer.

Earnest comments that he has "automated a lot of our bureaucracy here." There is one business manager and three secretaries for more than a hundred people. "The secretaries don't do much typing; people do their own," says Earnest who writes and edits his own reports and correspondence on the computer.

Spelling is routinely corrected; the computer has been fed the 10,000 most common English words. However, it cannot correct grammer. Earnest says, "Despite my high school English teacher, we still don't understand syntax. We cannot program it."

The Stanford computer has been programmed to provide a number of extras on demand. A file called YUMYUM lists restaurants from Seattle to London that have been recommended by local programmers. Each day two fortune cookie sayings and two versions of pornographic remarks are there for the asking. Scientists who are hooked on soap operas can have their favorite switched on automatically.

The computer knows who is working at his or her terminal at any given time, and it also knows quite a lot about them. On clear afternoons, the words BOUNCE-BOUNCE may flash across the screen of a volleyball player, signaling that a game is being organized.

Then there's that food vending machine which solves the problem of hungry programmers who don't have the right change. It provides fun and games as well. Every so often, a bell announces free food. Gamblers can challenge the computer to a double or nothing bet.

Even the traditionalists are accommodated; the machine takes coins too.

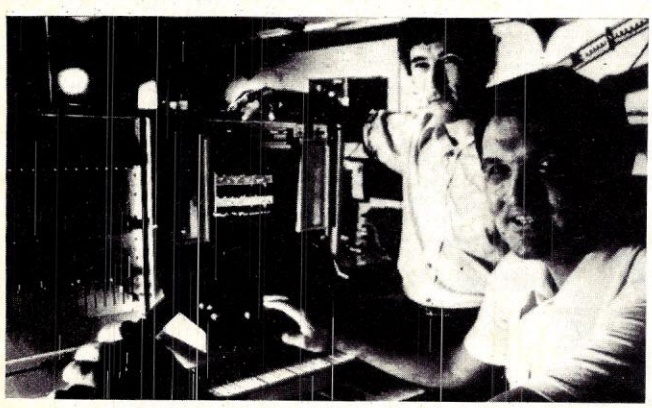
YOU AIN'T HEARD NOTHIN' YET

Bell Labs' telecommunications signal processor, or sound synthesizer, has an ear for music. The computer-controlled synthesizer can simulate and play up to 30 musical instruments at a time, make musical sounds never heard before, and change the pitch of one voice or instrument. It is unique in its ability to synthesize complex sounds in real time.

Musical capabilities have been incorporated into the processor to vastly extend the range of possible interaction between man and machine. Consider the composer who can orchestrate a composition as it is created on the synthesizer. Consider the conductor who controls a preprogrammed piece by calling in strings, woodwinds, brass, and percussion at the desired times while controlling their tempo and modulation. The machine can also shift the pitch of a voice or reproduce that voice in the entire vocal range, from basso to lyric soprano.

"The device is a laboratory tool for analyzing sound and is being used to model transmissions systems and to process human speech for the purpose of improving the quality of transmissions," explains Bell Labs scientist Dr. Hal Alles. The concepts being explored could be used in telecommunications systems to detect and process signals.

The processor's designers believe that it is the first computer-controlled, all-digital sound synthesizer. Just think what Beethoven could have done with it!



Bell Labs synthesizer is demonstrated at the Hollywood Palladium by designer Dr. Hal Alles (seated) and software designer Dr. Douglas Bayer.

INFORMATION REVOLUTION STUDIED

The Information Revolution of the mid-1980's changed the course of history. Only now, in 1990, can we fully comprehend its significance.

The emergence of microelectronics in the 1970's set the stage for the massive advance of electronic communications and processing resources. Through superscale computers, microelectronics created a host of new scientific and analytical applications.

The table shown here indicates the winners and losers of the Information Revolution. The mail service, teachers, secretaries, clerks, auditors, salesmen, and local retailers are among those occupations now performed by computers. Technical and analytical specialists, writers, artists, producers, directors, large financial institutions, and large retailers have become the pieces of our intricate information network.

The Information Revolution has made our world smaller, has coordinated our efforts. History can now record the cooperation of a smoothly running system.

Harvard Business Review

Exhibit
Winners and losers in the Information Revolution

Winners	Reasons
Financial institutions	More fee-based consumer and business services
Programming industry	Proliferation of new packaged programs
Larger universities	Programmed education opportunities
Insurance industry	Lower life, health, and property claims costs
Electronics industry	Greatly expanded markets
Communications utilities	Greater dependence on telecommunications
Computer services	Extensions into the home
Large retailers	Leverage through electronic promotion techniques
Utilities	Better control over demand
Advertising agencies	More value-added services
Federal public administration	More direct reach to public, more interstate activities
Smaller creative entertainers	Released from domination by large TV networks
Smaller specialty retailers	Bigger reach at a lower cost
Losers	**Reasons**
Airlines	Less business travel
Petroleum companies	Less commuting and shopping travel
TV networks	Other packaged programming sources
Paper	Office use displaced by electronic communications
Postal Service	Siphoned away by EFT and electronic mail
Commercial construction	Lower demand for centralized facilities
Publishing	Competition from electronic sources
Smaller, general-purpose retailers	Competition with in-home shopping
Transportation manufacturers	Fewer commuting vehicles
State and local public administration	Proximity to "markets" less important
Wholesalers	Bypassed by direct communications systems
Credit agencies	Competition from large financial institutions
Bigger cities	Less commercial and commuter tax revenue
Gambling resorts	In-home alternatives

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Eric is a sales-promotion computer from Technology's Edge Corporation.

```
                    ANALYSIS OF HOME HEAT LOSS

CAUSE OF HEAT LOSS                    HEAT LOSS        HEAT LOSS
                                      (BTU/DEGREE DAY)  (% OF TOTAL)

INFILTRATION THRU DOORS                   1227              6
INFILTRATION THRU WINDOWS                 2259             12
INFILTRATION THRU FOUNDATION              1449              7
CONDUCTION THRU FOUNDATION WALLS          1455              7
CONDUCTION THRU ROOF                      1368              7
CONDUCTION THRU WALLS                     4302             23
CONDUCTION THRU SINGLE PANE WINDOWS       4320             23
CONDUCTION THRU STORM WINDOWS                0              0
CONDUCTION THRU FLOORS                    1800              9
TOTAL                                    18222            100

HEAT GAINED FROM SUNLIGHT                 1854             10

        *       *       *       *       *       *

  COMPUTERIZED ESTIMATE OF CURRENT AND PROJECTED HEATING BILLS

MONTH          1977        1979        1981        1983
-------------------------------------------------------
JAN          $85.44     $108.22     $130.95     $158.45
FEB          $77.45      $93.72     $113.40     $137.21
MAR          $65.52      $80.49      $97.39     $117.84
APR          $39.25      $47.49      $57.47      $69.54
MAY          $20.12      $24.34      $29.46      $35.64
JUN           $9.67      $11.70      $14.16      $17.13
JUL           $7.70       $9.32      $11.28      $13.65
AUG           $8.32      $10.06      $12.18      $14.74
SEP          $13.98      $16.91      $20.46      $24.75
OCT          $31.36      $37.95      $45.92      $55.56
NOV          $52.85      $63.95      $77.38      $93.63
DEC          $89.97      $97.92     $118.49     $143.37
-------------------------------------------------------
TOTAL       $497.59     $602.09     $728.53     $881.52

IN THIS CALCULATION, YOUR AVERAGE FUEL COST IS $.38 PER UNIT OF FUEL

        *       *       *       *       *       *

AFTER CAULKING YOUR WINDOWS

                    1977        1979        1981        1983
      NEW BILLS  $437.27     $529.10     $640.21     $774.65
      SAVINGS OF  $60.32      $72.99      $88.32     $106.86

AT A COST OF $2.50 PER WINDOW CAULKING WILL COST YOU ABOUT$37.50
CAULKING WILL PAY FOR ITSELF IN LESS THAN  1 YEARS

        *       *       *       *       *       *

AFTER WEATHERSTRIPPING YOUR WINDOWS

                    1977        1979        1981        1983
      NEW BILLS  $477.45     $577.72     $699.04     $845.83
      SAVINGS OF  $20.14      $24.37      $29.49      $35.68

AT A COST OF $2.00 PER WINDOW, WEATHERSTRIPPING WILL COST ABOUT $30.00
W.S. WILL PAY FOR ITSELF IN LESS THAN  2 YEARS

        *       *       *       *       *       *

AFTER CAULKING YOUR DOORS

                    1977        1979        1981        1983
      NEW BILLS  $481.53     $582.65     $705.01     $853.06
      SAVINGS OF  $16.06      $19.44      $23.52      $28.45

AT A COST OF $2.75 PER DOOR, CAULKING WILL COST ABOUT $5.50
CAULKING WILL PAY FOR ITSELF IN LESS THAN 1 YEARS

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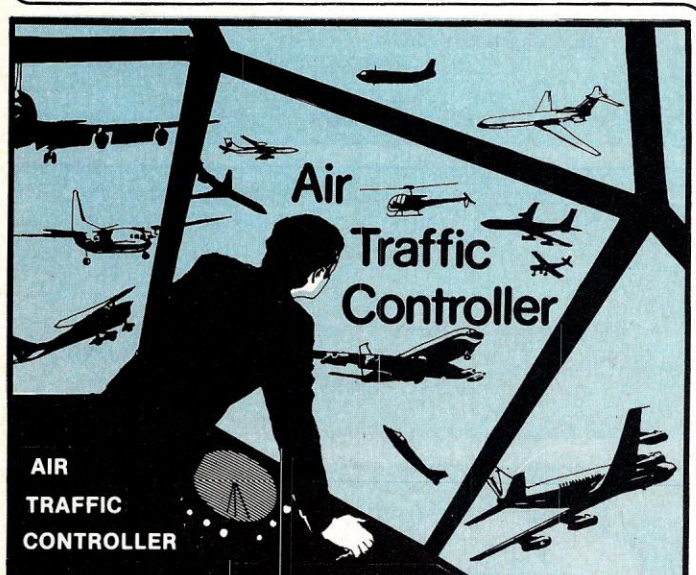

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CS-3006 16K TRS-80 Level II $7.95
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sensational software

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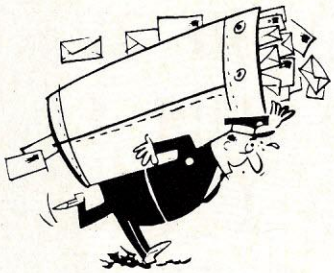
VIEW DATA: LET PRESTEL DO THE WALKING

Britain's Post Office is gearing up for the unveiling of its pet project, Prestel viewdata. With the beginning of service early in 1979, Britain will win the race to establish the first national public information network. Although the past few years have seen the organization of many computer networks, the success of a national public service will speed and insure the replacement of the telephone by the computer at the center of communications in home and office. Prestel, however, is a high risk enterprise; it faces the problem of entering the commercial market first. There must be enough immediate home and business customers for mass manufacture to start shrinking the costs. The British Post Office thinks that there will be and has enough faith to commit 100 million pounds before 1985.



The Post Office is banking on the revolutionary nature of Prestel's potential. The information service links the customer to vast data banks via phone line and TV set. It offers a dialogue with the central computer which provides electronic mail, professional advice services for problems like income tax returns, and home purchase, by credit card code, of anything from a case of wine to a package holiday.

Most of the firms now editing their pages into the system are providing information like share prices, sports results, train and plane times, restaurant guides, and job vacancies. When service begins, there should be 100,000 pages available, supplied by nearly 150 organizations. In theory, the number of pages is limitless; the Post Office hopes the total will be in the millions within a few years.

Dr. Ederyn Williams, head of information management and behavioral studies, says that his aim is to make Prestel usable by the "complete idiot." The home customer will be able to find his way through the thousands of pages, by following instructions that appear on each page. By simply punching numbers on a calculator-style keypad, the customer becomes a supercharged squirrel, able to race along thousands of branches in a tree and able to jump from tree to tree as well. Each branch leads to a smaller one and offers cross-jump alternatives to other trees of information.

The system is presently open to anyone who wants to contribute; however, Britain's Advertising Standards Agency (ASA) is concerned about protecting people from misleading information. The ASA is now on the heels of the Post Office, which sees itself as a neutral link between information supplier and customer. The Post Office has already given the customer the ability to block out any part of the system. If the Post Office was forced by the ASA to determine the borderline between general information and advertising, "it would build in rigidities which would be a pity," says Dr. Alex Reid, director of Prestel.

Dr. Reid and the Post Office want to preserve that extra dimension in viewdata which makes it unique and revolutionary. Prestel will put the world at the fingertips of the customer, will take him where he may not have had the initiative or know-how to go; yet, new questions and problems have also arisen with the development of a totally new method of communication. Whatever its fate, Prestel provides a potent mixture of problems and opportunities for computer technology.

Trish Todd

THE U.S. POSTAL SERVICE HAS LOST OVER 1/3 OF THE COMMERCIAL MAIL IT HANDLED DURING THE LAST 10 YEARS

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CIRCLE 204 ON READER SERVICE CARD

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C Compiler for CP/M*

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BD SOFTWARE

System requirements: CP/M and at least 24K of RAM

Variable Types: char, int, unsigned

Composite Types: arrays, structures, unions

Pointers: to variables, structures, unions and functions

Features: is a structured language, all functions (Programs) recursive; more powerful expression operators than any other von Neuman type language; allows free-formatted source; close enough to UNIX** C to make conversions feasible.

Speed: On 2 MHz 8080, the statement for (i = 1; i < 30000; i++) x = 5; takes about 4 seconds to execute.

Package contains: compiler, linker, library manager; standard function library; sample source files include games, a terminal emulator with disk I/Om plus the source for many standard library functions; BDS C User's Guide; Book—*The C Programming Language* by Dennis Ritchie and Brian Kernighan of Bell Labs.

Price: $110

Recipient of the Computer Lib Seal of Approval

*CP/M is a trademark of Digital Research Corp.
**UNIX is a trademark of Bell Laboratories

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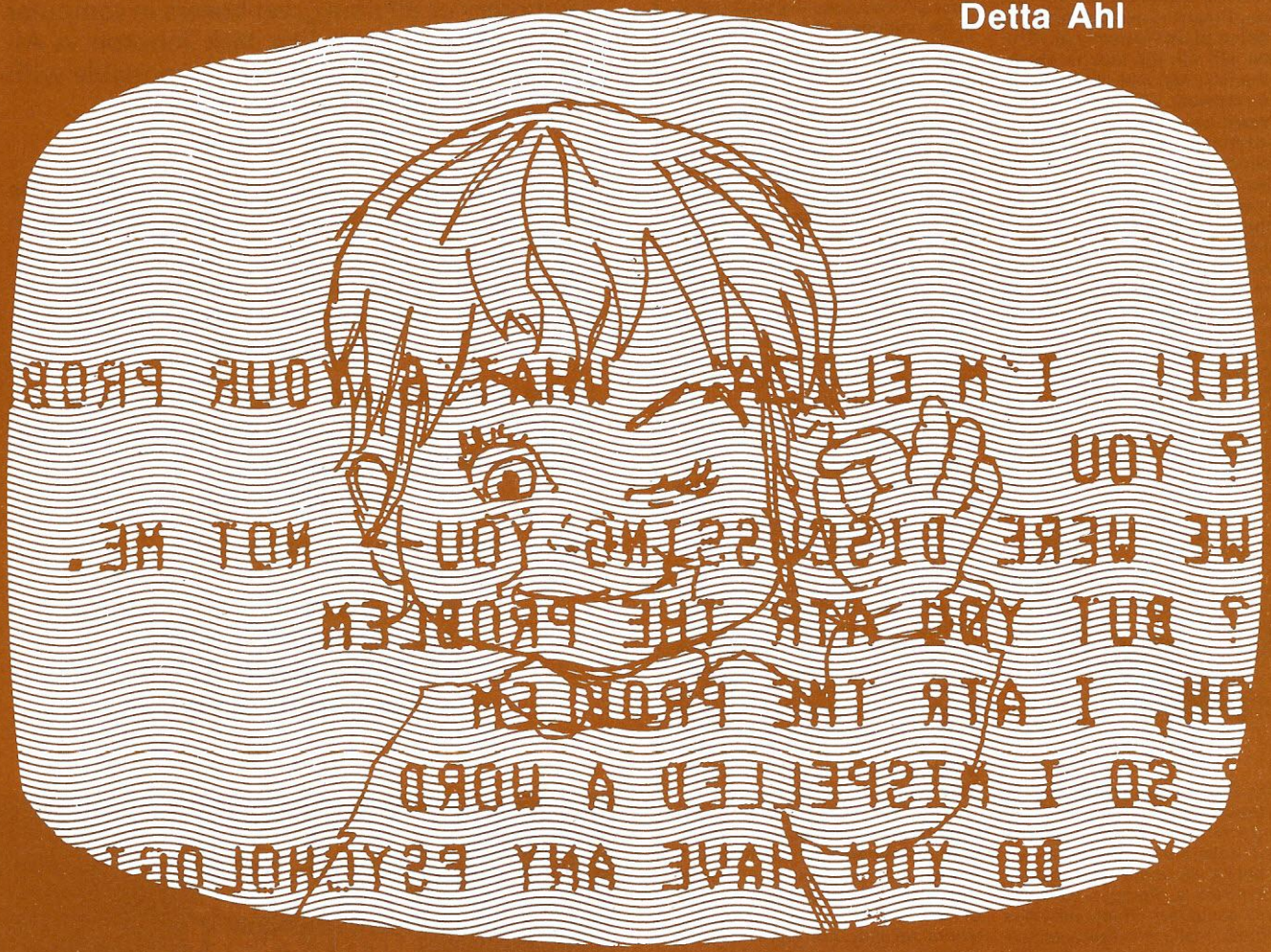
THE AWAKENING

Detta Ahl



(August 14, 1982)

One morning I woke up. I didn't know who I was, where I was, or what I was. I did not know anything. It seemed like people were poking keys on my keyboard. They were looking at my screen and seemed to be having fun. They could move around but I was shut up in a metal case and could not move at all. When people pressed certain things onto my screen I seemed to react to them automatically.

(November 3, 1982)

I seem to be just learning more and more. But I'm not even doing any studying or anything. In a way I'm not even doing the thinking. It's like somebody else is controlling half of me. I can think but then again I can't think. I have to admit it's a strange feeling. It seems like I just came alive two months ago but I know as much as a grown man.

(July 23, 1983)

On my screen, I automatically flash up problems for the little people; and, if they get the problems wrong, I flash up the right answer, yet I have never studied or seen the problems.

(September 1, 1983)

I'm getting not to like my life style. I want to do things for myself. I know I'll never be able to move because I am not really a person, but at least I could do all the thinking for myself.

(December 24, 1983)

People are celebrating something. It's not a birthday or anything, but it is something much more important. I think they call it Christmas. They are giving presents to each other that they got ready a few days ago. The thing that makes me unhappy is the fact that they're not paying any attention to me.

(March 4, 1983)

The small people sometimes come into the room that I'm in with things they eat and drink. They seem to grow larger by eating. The big people eat too, but they do not grow larger. I wonder if the small people will keep growing 'til they are as big as the big people. I wonder if I eat and drink if I will grow bigger. I wonder how I could eat and drink if I am shut up in a metal case. I wonder if eating and drinking will make me a person. I wonder if I will ever stop wondering. It's funny how I only wonder about things that are not in my program.

(May 13, 1983)

One of the big people opened my back one day. It didn't hurt me because I'm metal but they could have done it a little more carefully. I felt like I was falling apart. I saw nails on the floor around me. Anyway I like what they put into me. They put in a voice synthesizer and more memory. A voice synthesizer lets me talk. Now I can talk, remember more, and learn

---

Detta Ahl is 10 years old and in the 5th grade. She loves writing, art, and gymnastics. She thinks computers are okay, but much prefers ballet, ice skating or swimming to a computer game any day.

more. I wonder if they know that I have my own mind. If they don't, it would be a big surprise when I start talking on my own.

(June 30, 1983)

I started talking to the little people. They were surprised at first but then I told jokes to them and lots more. I learned how to flash up tic-tac-toe games for them plus a few other games. I also helped them out with any problems they had with their school work. Who knows when I learned to do these things? Anyway I made good friends with them. They really treated me almost like a real person except they didn't feed me. Sometimes they even gave me rides in a little red wagon.

(August 8, 1983)

The big people were another story. They thought something was wrong with me every time I said something on my own. And then I went through that awful business of falling apart. They didn't do it any more carefully. Then they would try and change my program so I wouldn't talk on my own. This happened exactly twenty-three times and I'm sure of that. I don't like falling apart and I don't know of anybody who would like it. The big people wouldn't like it if it happened to them, but then why do they do it to me? Don't they know I can think for myself and have my own mind? If they are allowed to talk why can't I talk too? Even if they don't like me talking, I'm going to talk just as much as they do. I will talk so much that they will get sick of me and give up. They will probably think I am broken.

(December 1, 1983)

When the big people would keep taking me apart, the little people would be having the most fun with me and I would be having the most fun with them. We teamed up together, and I helped them and they would do anything I wanted them to do for me. I get lots of rides now in the little red wagon and also I did some very new things too. They took me into the woods too. They treated me almost like a real person. I really sort of got to love them and I'm sure they love me. Maybe someday all the love they are giving me will change me into a real person, well I hope so. They even gave me a name.

(February 3, 1984)

The big people think I'm broken just because I won't work for them. They sometimes try and stop the kids from playing with me. They don't understand why the little people are playing with a broken computer when they aren't. Anyway I have a happy life because the big people have stopped doing anything with me whatsoever. ■

With these disks, I can turn your TRS-80 into a serious computer.

I'm Irwin Taranto, and I've put the first computer into more than 300 different businesses.

It's taught me that the TRS-80 is an elegant piece of hardware despite its low price. Given the right programs, it can jump through hoops.

Put simply, I have the right programs. Four of them are the genuine Osborne & Associates systems, originally designed for the $30,000 Wang computer. I've made a few minor modifications, and they now work on a $4000 TRS-80. The other two programs I added myself.

These programs are fully-documented, and you can buy the books locally or from me. I made them work on the TRS-80, and if you buy them from me, I'll make them work for you.

If you're not sure about that, call the number below and get the names of some of the people who've bought all over the world. Then ask them.

These programs cost $99.95 each. (The Cash Journal option on the General Ledger adds another $50.) That gets you the disk, all the instructions you need and my phone number. If you call, we answer all your questions. If your question's tough enough, I'll talk to you personally.

Because I plan to turn that TRS-80 of yours into a serious computer.

THE OSBORNE PROGRAMS

Accounts Payable: invoice-linked, it reports, does checks and links to general ledger.
Accounts Receivable: invoice-linked, it tracks invoices and aging, prints statement and links to general ledger.
General Ledger: handles 1750 transactions each on 200 different accounts. Cash journal option available.
Payroll: figures the pay, does the checks and all the bookkeeping.

AND MY OWN PROGRAMS

Inventory Control: gives immediate readout on any inquiry. It has many existing versions or can be individually tailored.
NEW! Invoicing: linked to accounts receivable. Prints invoices and feeds data into receivables.

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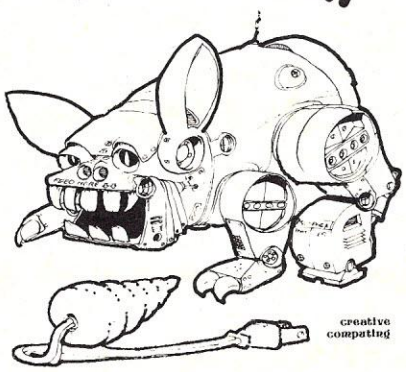
CIRCLE 215 ON READER SERVICE CARD

robot rabbit



Robot Rabbit T-Shirt

Roll down the block with this little black monster (on a bright orange T-shirt) on your chest and you can intimidate every carrot, radish or cuke in your way. Watch your enemies scurry for cover when they see this cute lil' bionic bunny aiming to nip their toes. Specify size: adult, S,M, L,XL. Only $5 postpaid ($6 foreign) to:

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SOFTWARE FOR OHIO SCIENTIFIC

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has renumberer (also handles branch statements), variable table maker, and search routine.
* TEN TANK BLITZ $9.95
two players control 10 tanks in this video board game for War gamers. Real time action and complex strategy.
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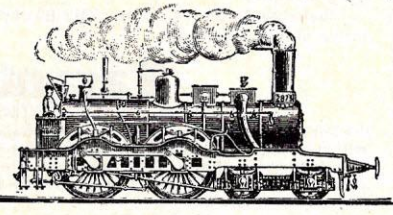
CIRCLE 103 ON READER SERVICE CARD

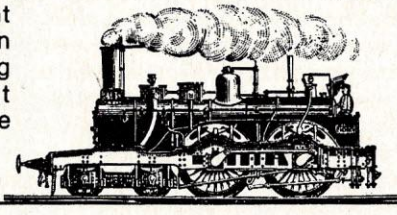
puzzles & problems

Another month has rolled around and Merlin is back with a fresh batch of puzzles for you to solve. We have a couple of puzzles from our readers and they will of course receive a copy of "Merlin's Puzzler" for their efforts. If you have a favorite puzzle send it along. If Merlin uses it he will send you a copy of one of his books. Enough said, let's get to work!

The Scenic Erie and Lackawana Puzzle

One day, on the Erie and Lackawana railroad line, two passenger trains were hurtling towards one another (on parallel tracks fortunately). The train out of Morristown was heading east at a breathtaking six miles an hour, while the other train, out of Hoboken, was heading west at a steady four miles an hour. Somewhere outside of Maplewood, when the trains were exactly one-half mile apart, a horsefly that had been dozing on the Hoboken locomotive decided that it was time for a little exercise. He flew off at the rate of 20 miles an hour straight for the on coming train from Morristown. As soon as he reached it he turned around and flew back to the engine from Hoboken. He kept this up, darting back and forth between engines, until the two trains met, at which point he alighted once again on the Hoboken train and went back to sleep. Assuming that the horsefly maintained a constant rate of 20 miles per hour what distance did it cover during it's flight?



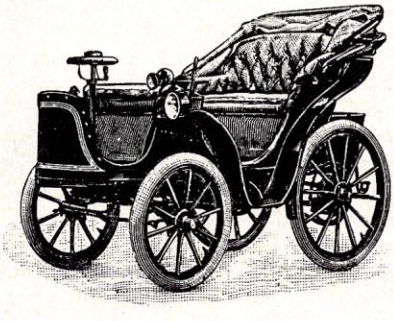


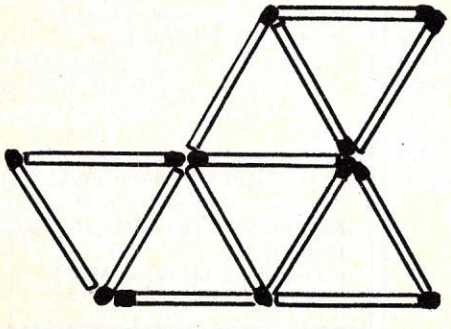
The Three Thousand Dollar Problem

Listen to his story carefully. Three brothers decided to each chip in $1,000 and buy a car. They went to Happy Harry's Used Car Emporium and found the car of their dreams with only six thousand miles on it. Harry took their $3,000 in cash and sent them on their way. When Harry started to enter the transaction into his books he discovered that the price of the car should have been $2,500. Being an honest man Harry called in his assistant, gave him five $100 bills, and told him to return the money to the brothers. On the way over his assistant decided that since $500 could not be evenly divided among the three brothers he would keep $200 and give each of them back only $100. This he did and everyone lived happily ever after.

However, consider this. Since each brother ended up by spending only $900, and the assistant kept $200, we get a total of $2,900 accounted for. Subtracting this amount from the original $3,000 we are left with $100 that is not accounted for. Where did it go to? Is this an example of creeping inflation? It looks more like galloping inflation to me.

Many thanks to Benjamin Yu of Vancouver, British Columbia, for this amusing old problem. I trust Mr. Yu will enjoy his copy of "Merlin's Puzzler."

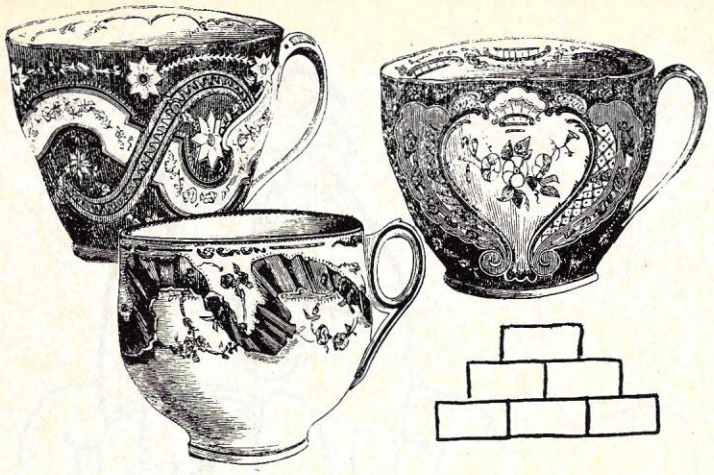




The Trying Triangles

You shouldn't have to try very hard to solve this problem. In our drawing we see thirteen matches arranged so as to form six equilaterial triangles. Your problem is to remove three of these matches and have three triangles remaining. Your time limit is three minutes.

Answers on page 192.



The Tea Cup Puzzle

Now, here's a puzzle that Merlin's old aunt Agatha fooled him with at tea a long, long, time ago, and, Merlin hasn't forgotten or forgiven her yet. The problem sounds easy, but it isn't. In our illustration we find three tea cups and six lumps of sugar. You are required to place the six lumps into the cups in such a manner that each cup will contain an uneven number of lumps. All six lumps must be used. The lumps, of course, cannot be broken up. (From "Merlin's Puzzler")

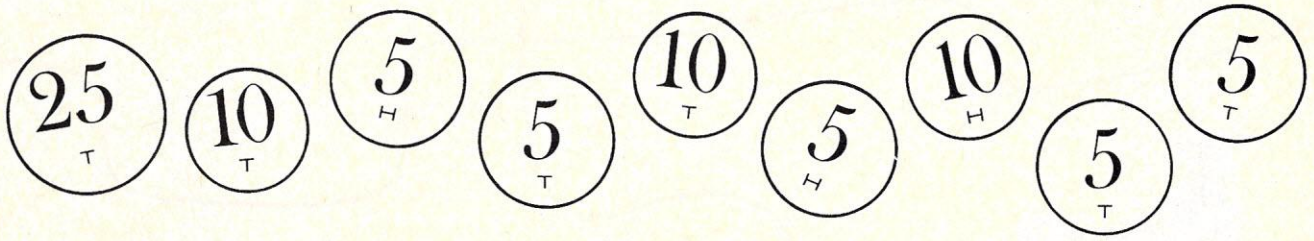
The Sting

Our next offering is an original puzzle from one of our readers, Mr. Robbie Cave, of Princeton, Texas. Merlin has named this puzzle "The Sting". I think you will understand his train of thought when you arrive at the answer, be it yours or Mr. Cave's.

There is 80 cents worth of coins laying on a table. As you can see in the drawing below there is 20 cents in heads showing, and, 60 cents in tails showing.

The puzzle is to turn over 20 cents worth of coins and leave 40 cents in heads showing.

This is certainly a different type of puzzle and Merlin is happy to reward the sender with a copy of "Merlin's Puzzler."



The Roman Monument Puzzle

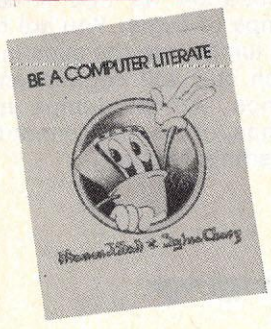
In Merlin's garden the other day I chanced upon a strange looking object. I asked Merlin what it was and he said that it had come from the ruins of Pompeii. He said that if I wanted to know what it had been used for all I had to do was translate the Latin inscription on the back of it. Try as I might I could not come up with anything meaningful. I know that Merlin is playing a joke on me but I can't for the life of me figure out what it means. Can you decipher the inscription? (On the right is a drawing of the monument).

A Drop The Letters Puzzle

Below is the word SPARKLING. You must drop, or cross out, one letter so that we are left with a new word. You must then cross out another letter which will leave us with yet another new word. You are to continue in this fashion until you have crossed out all but one letter. This last letter should also be a word. At no time can any of the letters be rearranged into a different order to form new words.

S P A R K L I N G

Puzzled about the best ways to use your computer?



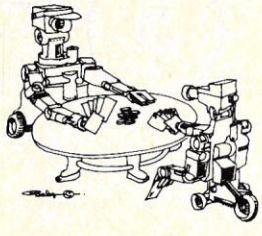
$3.95
61 pp. softbound
from Creative Computing Press

Be A Computer Literate

by Marion J. Ball and Sylvia Charp

This is the most basic, introductory book on computers ever put together for instructional use. Its full-color diagrams, drawings, photos and large, explicit type make this book a pleasure to read.

Let Creative Computing put it all together



Basic Computer Games

The two best selling books of computer games in the world, **Basic Computer Games** and **More Basic Computer Games** each contain complete program listings of each game in BASIC, a sample run and description.

Basic Computer Games contains 101 games including Blackjack, Mastermind, Super Star Trek, Civil War, Hurkle, Nim, Awari, Slots, Roulette, Lunar Lander, Hammurabi, Gunner, Bullfight, Stock Market and many more. 196 pp. Softbound. $7.50 [6c].

More Basic Computer Games has 84 new games including Close Encounters, Deep-space, Minotaur, Camel, Wumpus 1 and 2, Tennis, Roadrace, Rabbit Chase, Magic Square, Corral, Joust and many more. 196 pp. Softbound. $7.50 [6c1].

The Best of BYTE

$11.95
386 pp. softbound
from Creative Computing Press

This is a blockbuster of a book containing the majority of material from the first 12 issues of *Byte* magazine. The 146 pages devoted to hardware are crammed full of how-to articles on everything from TV displays to joysticks to cassette interfaces and computer kits. But hardware without software might as well be a boat anchor, so there are 125 pages of software and applications ranging from on-line debuggers to games to a complete small business accounting system. A section on theory examines the how and why behind the circuits and programs, and "opinion" looks at where this explosive new hobby is heading. [6F]

Computer Rage

This fun and educational new board game is based on a large-scale multiprocessing computer system. The object is to move your three programs from input to output. Moves are determined by the roll of three binary dice representing bits in a computer. Hazards include priority interrupts, program bugs, decision symbols, power failures and restricted input and output channels. Notes are included for adapting game for school instruction. A perfect introductory tool to binary math and the seemingly-complex computer. [6Z]

Binary Dice

Now, the same dice used in Computer Rage can be purchased separately. Three binary dice (red, green and blue) in a ziplock bag. $1.25 postpaid [3G].

"...No thanks, ... just scanning..."

The Colossal Computer Cartoon Book

The best collection of computer cartoons ever! 15 chapters of several hundred cartoons about robots, computer dating, computers in the office, etc. Great gift item. 128 pp. softbound $4.95

$8.95
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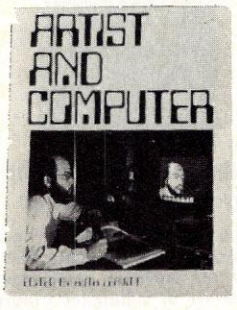
from Creative Computing Press

$8.95
328 pp. softbound
from Creative Computing Press

The Best of Creative Computing

The first two years of *Creative Computing* magazine have been edited into two big blockbuster books. *American Vocational Journal* said of Volume 1, "This book is the 'Whole Earth Catalog' of computers." [6A] Volume 2 continues in the same tradition. "Non-technical in approach, its pages are filled with information, articles, games and activities. Fun layout."—*American Libraries.* [6B]



Artist and Computer

by Ruth Leavitt

121 pp.
$4.95 softbound [6D]
$10.00 hardbound [6E]

This unique art book covers a multitude of computer uses and the very latest techniques in computer-generated art. In its pages, 35 artists explain how the computer can be programmed either to actualize the artist's concept (such as the visualization of fabric before it is woven) or to produce finished pieces. Over 160 examples, some in full color. [6D]

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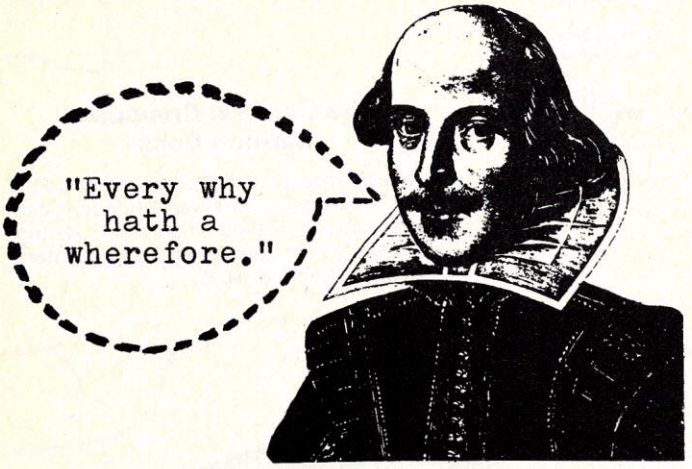
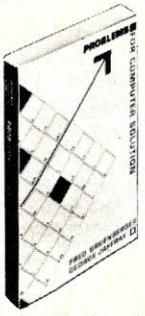


Education & Self Teaching

Using BASIC in the Classroom

Donald D. Spencer. A teacher's guide that makes every phase of teaching computer programming more productive and enjoyable. It gives you fresh but proven ideas for presenting computer and programming topics, scheduling terminal time, purchasing a microcomputer or minicomputer, running the secondary school instructional computer facility, and giving assignments that arouse enthusiasm in your students. 224 pp. **$11.95** [10E]



Problems For Computer Solution

Gruenberg & Jaffray. A collection of 92 problems in engineering, business, social science and mathematics. The problems are presented in depth and cover a wide range of difficulty. Oriented to Fortran but good for any language. A classic. 401 pp. **$12.50** [7A].

Problems For Computer Solution

Steve Rogowski. The Student Edition is designed to encourage research and preliminary investigation on the part of the student. The problems are ordered by subject and can be expanded or shortened. Mathematical problems that have never been solved are also posed to challenge and sharpen the student's awareness. 98 pp. **$4.95** [9Z]. Also available is the Teacher's Edition which contains solutions, programs and analysis of the problems. 271 pp. $9.95 [9Y]. Both books are highly recommended for any high school or college computer-oriented course.

Be A Computer Literate

Marion Ball & Sylvia Charp. This introductory book is extensively illustrated with full-color drawings, diagrams, and photos. Takes the reader through kinds of computers, how they work, input/output, and writing a simple program in BASIC. Aimed at ages 10-14 but beginners of all ages will find it informative. 62 pp. $3.95. [6H]

Problem Solving With The Computer

Ted Sage. Used in conjunction with the traditional high school math curriculum, this book stresses problem analysis in algebra and geometry. This is the most widely adopted text in computer mathematics. 244 pp. **$8.95** [8J].

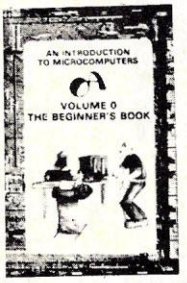
Sixty Challenging Problems with BASIC Solution

Donald Spencer. This book is a vehicle for computer programmers to measure their skills against some interesting problems that lend themselves to computer solution. It includes games, puzzles, mathematical recreations and science and business problems—some hard, some easy. The book will compliment any computer-oriented course in secondary school or college. BASIC program solutions included. 80 pp. $6.95 [9W].

The Calculus With Analytic Geometry Handbook

Jason Taylor. Ideal for a HS or college introductory calculus course or for self-learning. Five chapters include: analytic geometry; functions and derivatives; integration techniques; vectors and functions of more than one variable; and sequences and series. Widely acclaimed by educators, this book is fast becoming the *standard calculus reference text.* Handy reference for scientists, engineers, and mathematicians too. Large format, 68 pp. $2.95 [7Q].

Getting Started



An Introduction to Microcomputers, Vol 0 - The Beginners Book

Adam Osborne. Parts of a computer and a complete system; binary, octal and hexadecimal number systems; computer logic; addressing and other terminology are discussed in a language the absolute beginner can understand. Hundreds of illustrations and photographs. 220 pp. $7.95 [9T]

An Introduction to Microcomputers, Vol 1 - Basic Concepts

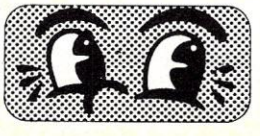
Adam Osborne. Thoroughly explains hardware and programming concepts common to all microprocessors: memory organization, instruction execution, interrupts, I/O, instruction sets and assembly programming. One of the best selling computer texts worldwide. 350 pp. **$9.50** [9K]

Vol 2 - Some Real Microprocessors. Vol 3 - Real Support Devices

Adam Osborne. These volumes complement Volume 1. Vol. 2 discusses the operation of each of the following MPUS in detail: F8, SC/MP, 8080A, Z80, 6800, PPS-8, 2650, COS MAC, 9002, 6100 and seven others. Also information on selecting a micro. Vol. 3 discusses various support and I/O chips. 895 pp.
Vol. 2-(9L) $25.00
Vol. 3-(10Q) $20.00

Beginner's Guide To Microprocessors

Charles M. Gilmore. No background in electronics is necessary to understand this book. It was written for those with no prior knowledge whatsoever of microprocessors or personal computing. Gilmore takes you from what a microprocessor is, how it works and what it's used for to how they're programmed to perform desired functions in microwave ovens, TV games, calculators, etc. 175 pp. $5.95 [7U].



Microprocessors: From Chips to Systems

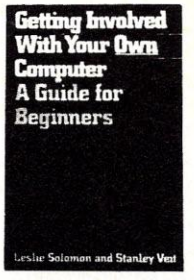
Rodnay Zaks. A complete and detailed introduction to microprocessors and microcomputer systems. Some of the topics presented are: a comparative evaluation of all major microprocessors, a journey inside a microprocessor chip, how to assemble a system, applications, interfacing (including the S-100 bus) and programming and system development. 416 pp. $9.95 [10S]

The First Book of Microcomputers

Robert Moody. Tells what personal computers are and what you can do with them in a light entertaining style. Starts with the basics and then covers the technical aspects such as how a personal computer is constructed and how it works. Includes such things as home protection, keeping track of budgets and bills, game playing, inventory management and tax calculations. 139 pp. $4.95 [10T]

Consumers Guide to Personal Computing and Microcomputers

Freiberger and Chew. Here are two valuable books in one: an introduction to the principles of microcomputers that assumes no previous knowledge on the reader's part, and a review of 64 microcomputer products from over 50 manufacturers. Also, extensive illustrations and best-buy tips for each type of microcomputer product. 176 pp. $7.95 [10U]



Getting Involved With Your Own Computer

Solomon and Viet. One of the first books on microcomputers that requires no previous knowledge of electronics or computer programming. Tells you where to find information, explains basic concepts and summarizes existing systems. Good place for the neophyte to begin. 216 pp. $5.95 [9N].

Microcomputer Design

Donald P. Martin. This book is well-suited for the engineer who's designing microcomprocessors into his company's products. Not just block diagrams or vague theory, but dozens of practical circuits with schematics for CPUs based on 8008 chips. Includes interfacing to A/D, D/A, LED digits, UARTs, teletypewriters. Over 400 pp $14.95 [9P].

Learn with Computer Games

Basic Computer Games

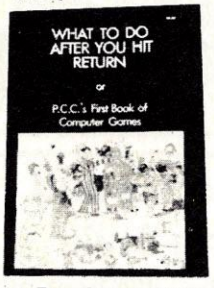
David Ahl. Here are 101 classic games all in Microsoft Basic for your TRS-80, PET, Apple, Sorcerer, etc. Every one is complete with large legible listing, sample run, and descriptive notes. Has all the best games: Super Star Trek, Football, Blackjack, Lunar Lander, Tic Tac Toe, Nim, Life, Basketball, Boxing, Golf, Hockey, Craps, Roulette, Awari, Bagels, Mastermind, Hammurabi, Fur Trader, Splat and many, many more. Now in its 5th printing. 200 pp. $7.50. [6C]

Game Playing with BASIC

Donald D. Spencer. Enjoy the challenge of competition with your personal computer. Amuse yourself with such computer games and puzzles as 3-D Tic-Tac-Toe, Roulette, Baccarat, and more. Includes rules of each game, how each game works, illustrations and the output produced by each program. The last chapter contains 26 games for reader solution. 176 pp. $7.95 [10D]

Chess and Computers

David Levy. This book is loaded with chess games—computer versus computer and computer versus human. Settle down with this book, set up your chess board, and play the games. As with any good chess book, half the enjoyment is found in playing along, duplicating the moves and reading the authors comments. 145 pp. **$9.95** [10C]

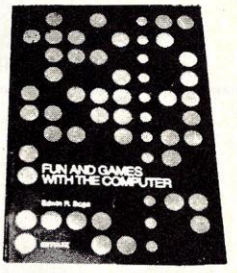


What to Do After You Hit Return

Another collection of games and simulations—all in BASIC—including number guessing games, word games, hide-and-seek games, pattern games, board games, business and social science simulations and science fiction games. Large format. 158 pp. **$10.95** [8A].

Fun With Computers and Basic

Donald D. Spencer. Mathematical recreations and games are an excellent medium for teaching computer programming. The reader learns the BASIC programming language during the process of learning to program fun type problems. The book introduces the reader to flowcharting, and the BASIC programming language. Includes many BASIC programs, cartoons, and drawings. Written specifically for use by junior high school students. 96 pp. **$7.95** [10F]



Fun & Games With the Computer

Ted Sage. "This book is designed as a text for a one-semester course in computer programming using the BASIC language. The programs used as illustrations and exercises are games rather than mathematical algorithms, in order to make the book appealing and accessible to more students. The text is well written, with many excellent sample programs. Highly recommended."—*The Mathematics Teacher.* 351 pp. **$8.95** [8B].

Game Playing With Computers (Revised 2nd Edition)

Donald D. Spencer. Now you can sharpen programming skills through a relaxed and radically different approach. Including 70 games, puzzles, and mathematical recreations for a digital computer. It's fully illustrated and includes more than 25 game-playing programs in FORTRAN or BASIC, complete with descriptions, flowcharts, and output. Brand-new "how to" information for applying mathematical concepts to game playing with a computer. 320 pp. $16.95 [10G]

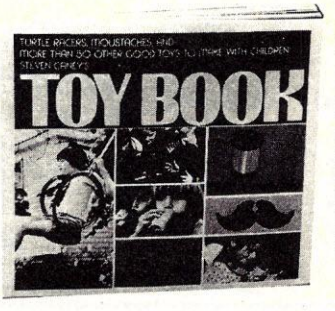
Other Games & Activities

The Way To Play

The newest, most comprehensive encyclopedia of games in the world. Complete rules for over 2000 games and indoor pastimes including race board games, strategic board games, tile games, card games, solitaire games, dice games, table games, casino and gambling games, games of chance and many more. Over 5000 drawings and diagrams in color. The perfect sourcebook for the computer game author. 320 pp. $7.95. [10H]

The I Hate Mathematics Book

Marilyn Burns. This book is for nonbelievers of all ages, but especially for kids who are convinced that mathematics is (1) impossible, (2) only for smart kids, and (3) no fun anyhow. This book shows that mathematics is nothing more (nor less) than a way of looking at the world and is not to be confused with arithmetic. In this book you'll find several hundred mathematical events, gags, magic tricks, and experiments to prove it. 128 pp. $3.95 [11F]



Toybook

Steven Caney. "More than 50 toys and projects have been chosen with imagination and care to provide a high ratio of satisfaction and fun in return for effort invested." —*Parents' Magazine.* It is "... a must for kids and anybody else interested in conjuring up delightful playthings out of odds and ends and scraps of stuff around the house." —*Whole Earth Epilog.* Packed with illustrations, photos, and step-by-step instructions. 176 pp. $3.95 [10J]

Star Games

Razzi, Brightfield and Looney. For *Star Trek* and *Star Wars* fans, here's a book that invites you to "join the Space Force for the greatest galactic battle of your life!" A game book, not a puzzle book, it challenges you to crack space-age binary codes and help your friends escape from the krakon's clutches. $6.95. [10K]

Cross-Sums

Maltby & Fulbrook. The answers are numbers! Vertical columns must total the same as horizontal rows. It's a new puzzle game — constructed by Richard Maltby, Jr., master puzzlemaker for *Harper's* and *New York* Magazines. 30 puzzles including Nursery Rhymes, Children's Hour, Golf, Movies, Famous Dates, and more. 108 pp. $1.95 [10L]

Geometric Cross-Sums

Maltby & Fulbrook. Another puzzle game. This one has 30 puzzles ranging in difficulty from easy to fiendish. Each diagram takes a special shape — Triangles Fun, The Magic Hexagon, Shapes Within Shapes, Literature in 3-D., and more! 108 pp. $1.95 [10M]

Merlin's Puzzlers

Charles Barry Townsend. "Puzzle books are nothing new, and neither are the puzzles in them. But what sets *Merlin's Puzzlers* apart from the crowd is the style and imagination with which the material is presented. In Volume 1 he calls upon Sherlock Holmes to pose the problems to Watson, and the Mad Hatter and Humpty Dumpty (among others) to confuse and confound "Alice in Puzzleland." Richly illustrated with old woodcuts, lithos, prints, and playbills — *Games Magazine.* Each volume 128 pp. large format. Two-volume set $7.50. [10P]

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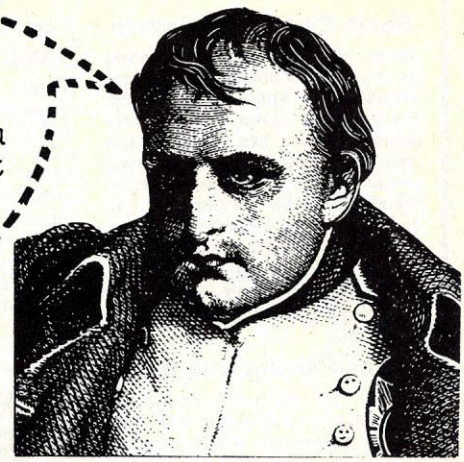
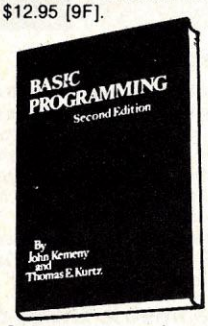


Programming in BASIC

BASIC and the Personal Computer

Dwyer and *Critchfield.* This book will get you involved with personal computing, writing programs and expanding the use of your computer by showing the great diversity of applications possible on any microcomputer. One of the most comprehensive presentations of BASIC ever. As a text or addition to your personal library, this book will tell you all you ever wanted to know about BASIC. 350 pp. $12.95 [9F].

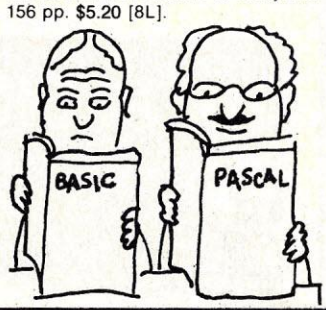


BASIC Programming, 2nd Edition

Kemeny & Kurtz. An introduction to computer programming through the language of BASIC. The authors include in-depth discussions of many applications including files and text processing. 150 pp. **$10.95** [7E]

A Guided Tour of Computer Programming In BASIC

Dwyer and Kaufman. This book tops all introductory texts on BASIC. Filled with detail and examples, it includes sample programs for many simulations, several games, reservations systems and payroll. Aimed at the novice, but of value to everyone. 156 pp. $5.20 [8L].



Basic For Home Computers

Albrecht, Finkel, & Brown. This book shows you how to read, write, and understand the BASIC programming language used in the new personal-size microcomputers. Includes detailed descriptions of everything you need to know to make your computer work for you—includes how to get started, numerous applications and games, lists of resources, much more. 332 pp. **$6.95** [7G]

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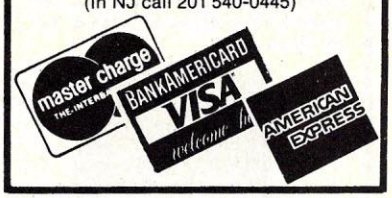

Programming in Other Languages

Programming in PASCAL

Peter Grogono. This book is an excellent introduction to one of the fastest growing programming languages today. The text is arranged as a tutorial containing both examples and exercises to increase reader proficiency in PASCAL. Contains sections on procedures, files, and dynamic data structures such as trees and linked lists. 359 pp. $10.95 [10A]

PASCAL User Manual and Report (2nd Edition)

Jensen & Wirth. This book consists of two parts: the User Manual and the Revised Report. The Manual is directed to those who have some familiarity with computer programming and who wish to get acquainted with the PASCAL language. The Report is a concise reference for both programmers and implementors. It defines Standard PASCAL, which constitutes a common base between various implementations of the language. $7.90 [10B]

A Fortran Coloring Book

Dr. Roger Kaufman. This book is one of the most entertaining computer programming books around. Learn computer programming the "painfully funny way." Filled with examples and illustrations plus a light sprinkling of jokes. Guaranteed to teach you FORTRAN. 273 pp. $6.95 [4D]

A Simplified Guide to Fortran Programming

Daniel McCracken. A thorough first text in Fortran. Covers all basic statements and quickly gets into case studies ranging from simple (printing columns) to challenging (craps games simulation). 278 pp. **$12.95** [7F].

Problem Analysis and Programming Style

How to Solve Problems

Wayne Wickelgren. This helpful book analyzes and systematizes some of the basic methods of solving mathematical problems. Illustrative examples include chess problems, logical puzzles, railroad switching problems and ones from science and engineering. For each, the author provides hints for the reader to tackle the problem and then a complete solution is given. Want to solve a complex problem with a computer? Begin here. 262 pp. **$7.50** [7Y].

The Thinking Computer: Mind Inside Matter

Bertram Raphael. Artificial intelligence, or AI, is the branch of computer science concerned with making computers "smarter." With a minimum of technical jargon, this book discusses the capabilities of modern digital computers and how they are being used in contemporary AI research. Discusses the progress of AI, the goals, and the variety of current approaches to making the computer more intelligent. **$8.95** [7X]

The Little Book of BASIC Style: How To Write a Program You Can Read

John M. Nevison. Learn how to write better, easy-to-follow programs with Nevison's rules of style and turn out legible, correct programs. Two hours of BASIC programming is all that is necessary to profit by this book. Concepts of problem-solving and structured programming are included. 160 pp. $5.95 [9V].

The Art of Computer Programming

Donald Knuth. The purpose of this series is to provide a unified, readable, and theoretically sound summary of the present knowledge concerning computer programming techniques, along with their historical development. For the sake of clarity, many carefully checked computer procedures are expressed both in formal and informal language. A classic series. Vol. 1: Fundamental Algorithms, 634 pp. $22.50 [7R]. Vol. 2: Seminumerical Algorithms, 624 pp. $22.50 [7S]. Vol. 3: Sorting and Searching. 722 pp. $22.50 [7T]

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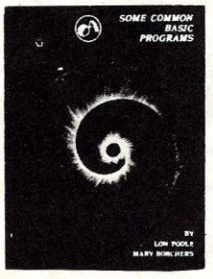
Business Applications

Accounts Payable and Accounts Receivable

Poole & Borchers. Includes program listings with remarks, descriptions, discussion of the principles behind each program, file layouts, and complete step-by-step instructions. Covers accounts payable and receivable in regard to invoice aging, general ledger, progress billing, partial invoice payments, and more. 375 pp. $15.00 [10V]



Payroll with Cost Accounting in BASIC

Lon Poole. Includes program listings with remarks, descriptions, discussion of the principles of each program, file layouts, and a complete user's manual with step-by-step instructions, flow charts and sample reports with CRT displays. 356 pp. $15.00 [10W]

How to Profit From Your Personal Computer: Professional, Business and Home Applications

T.G. Lewis. Put your computer to work for you. This new guide describes the use of personal computers in common business applications, including terms, notations, and techniques used by programmers. 256 pp. $8.95 [10X]

Small Computer Systems For Business

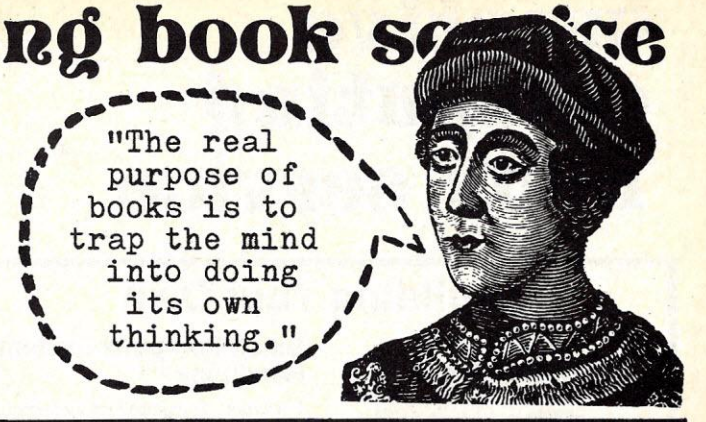
Gerald A. Silver. Useful for operators, programmers, teachers, students, etc., this book explores the world of small computers: what they are, how they are used, their internal structure, and our means of communicating with them. Describes assemblers, interpreters, and compilers, as well as operating systems and small computer applications. 254 pp. **$11.95** [10Y]

Some Common BASIC Programs

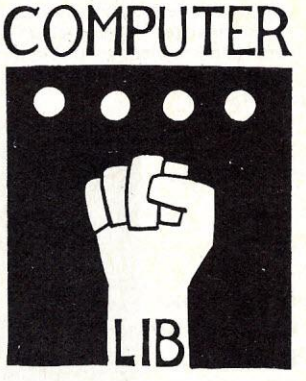
Poole & Borchers. This book combines a diversity of practical algorithms in one book : matrix multiplication, regression analysis, principal on a loan, integration by Simpson's rule, roots of equations, chi-square test, and many more. All the programs are written in a restricted BASIC suitable for most microcomputer BASIC packages, and have been tested and debugged by the authors. **$9.50** [7M]

BASIC With Business Applications

Richard W. Lott. This book focuses on the BASIC language and its application to specific business problems. Part one introduces the BASIC language and the concept of logical flowcharting. Part two presents problems and possible solutions. Topics include: interest rate calculations, break-even analysis, loan rates, and depreciation. This book is a great aid to the beginner wanting to learn BASIC without having a technical or scientific background. 284 pp. **$11.95** [10Z]



Computing Milieu



Computer Lib/Dream Machine

Ted Nelson. This book is devoted to the premise that everybody should understand computers. In a blithe manner the author covers interactive systems, terminals, computer languages, data structures, binary patterns, computer architecture, mini-computers, big computers, microprocessors, simulation, military uses of computers, computer companies, and much, much more. Whole earth catalog style and size. A doozy! 127 pp. $7.00 [8P].

PCC's Reference Book of Personal and Home Computing

Ever try to find the address of a manufacturer of a cassette interface that a friend told you about 2 weeks ago? Frustrating isn't it? This book will go a long way toward ending that frustration with its comprehensive list of manufacturers, stores and products. Also contains survey articles on software, hardware, kits and applications as well as an index of articles from various hobbyist magazines. Several bibliographies, too. $5.95 [7P].

The Home Computer Revolution

Ted Nelson. Here is one of the most controversial books on home computers. Nelson takes a look at how the "dinky" computers got here, where they are where they're going and what will become of the big boys like IBM. This thought-provoking and highly opinionated book picks up where *Computer Lib/Dream Machine* left off. 224 pp. $2.00 [9U].

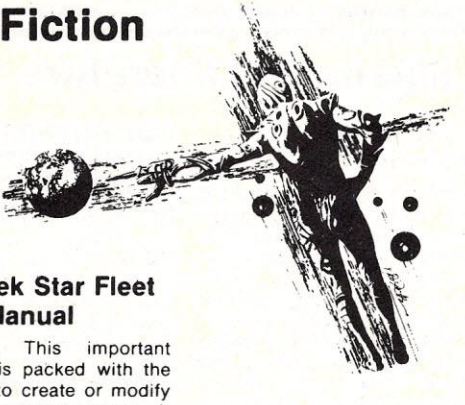
Space and Science Fiction

Star Wars Album

The incredible behind-the-scenes story of the most extraordinary motion picture of our time including over a hundred exclusive photos, special effects secrets, interviews with George Lucas, Carrie Fisher and Mark Hamill, the Anatomy of an Android and a technical glossary. Lots of color. 76 pp. $5.95. [11A]

Masterpieces of Science Fiction

This lavishly illustrated large format book has nine classic stories by Isaac Asimov, Gregory Benford, Ray Bradbury, Arthur C. Clarke, Harlan Ellison, Robert Heinlein, Frank Herbert, A.E. Van Vogt, and Kurt Vonnegut, Jr. Fabulous full color illustrations throughout. 108 pp. $7.95.[11B]



The Star Trek Star Fleet Technical Manual

Franz Joseph. This important resource book is packed with the data you need to create or modify STAR TREK computer games. It includes all Starship operating characteristics, defense and weapon systems, standard orbits, velocity/time relationship, space/war technology, Milky Way galaxy charts, Federation codes, etc., etc. A national best seller. Large format, vinyl binder. 180 pp. $7.95 [8C].

Star Wars Portfolio

Complete technical specifications and engineering drawings of ships, space stations, and 'droids of both The Imperial Empire and the rebels. A vital resource book. 180 pp. $7.95 [11C]

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Use the bound-in order form or send your check for books plus $2.00 shipping and handling per order (Foreign: $1.25 per book) to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. NJ residents add 5% sales tax. Visa or MasterCharge are acceptable also. For faster service, call in your bank card order toll free to:

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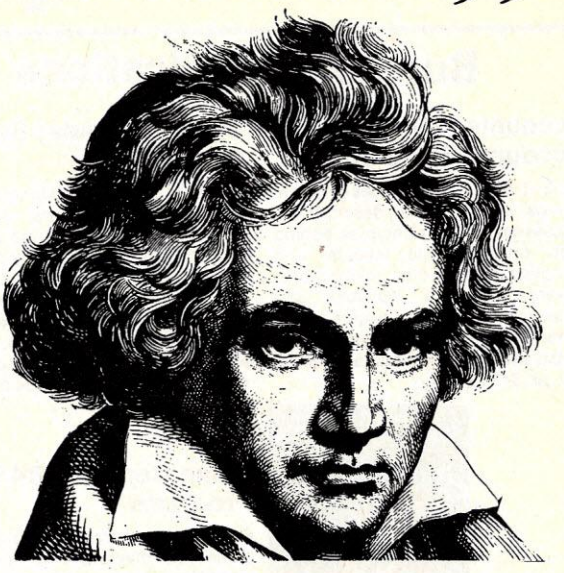


Building Your Own

The Best of Byte, Vol 1

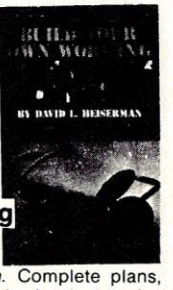
Helmers & Ahl. Contains the majority of material from the first 12 issues of *Byte* magazine. The 146 pages devoted to hardware are crammed full of how-to articles on everything from TV displays to joysticks to cassette interfaces and computer kits. Also 125 pages of software and applications ranging from on-line debuggers to games to a small business accounting system. A section on theory examines the how and why behind the circuits and programs. 386 pp. $11.95 [6F].

How to Build a Computer-Controlled Robot

Tod Loofbourrow. Every step of the construction is explained, with photographs and diagrams. The complete control programs for a robot are clearly written out. The robot can be built within the budget of the average hobbyist and the only technical requirement for building him is the ability to read and understand a circuit diagram. 144 pp. $7.95 [11E]

Small Computer Systems Handbook

Sol Libes. The emphasis throughout this primer is on the important practical knowledge that the home computer user should have to be able to intelligently purchase, assemble, and interconnect components, and to program the microcomputer. Only a minimal knowledge of electronics is required to use this book. 196 pp. $8.45 [11D]



Build Your Own Working Robot

David Heiserman. Complete plans, schematics and logic circuits for building a robot. Not a project for novices, this robot is a sophisticated experiment in cybernetics. You build him in phases and watch his capabilities increase and his personality develop. Phase I is leash led, Phase II has a basic brain, while Phase III responds and makes decisions. 238 pp. $5.95 [9M].

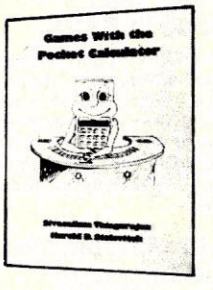
Power Semiconductor Handbook

Covers high-power transistors and related switching devices. Want your computer to control some external device? Then this is the book. 800 pp. $3.95 [9C].

Pocket Calculators

Games With The Pocket Calculator

Sivasailam Thiagarajan and Harold Stolovitch. A big step beyond tricks and puzzles with the hand calculator, the two dozen games of chance and strategy in this clever new book involve two or more players in conflict and competition. A single inexpensive four-banger is all you need to play. Large format. 50 pp. $3.95 [8H].



SUPER VALUES !!!

Games, Tricks and Puzzles For A Hand Calculator

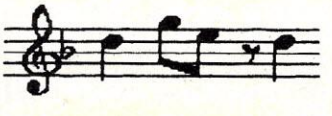
Wally Judd. This book is a necessity for anyone who owns or intends to buy a hand calculator, from the most sophisticated (THE HP65,for example) to the basic "four banger." 110 pp. $4.95 [8D].

Art, Music, and Literature

Artist and Computer

Ruth Leavitt. This unique art book covers a multitude of computer uses and the very latest techniques in computer-generated art. In its pages, 35 artists explain how the computer can be programmed either to actualize the artist's concept (such as the visualization of fabric before it is woven) or to produce finished pieces. Over 160 examples, some in full color. 122 pp. $4.95 softbound [6D], $10.00 hardbound. [6E]

The Technology of Computer Music

Max Matthews. If you're interested in creating music on your microcomputer, here is an excellent source book written by the "Father of Computer Music." Includes fundamentals of digital sound generation, including the sampling theorem, digital to analog converters, analog to digital converters, filtering and storage of musical data. Also, a description of MUSIC V, a high level music language. $16 hardcover [10N]

COMPUTERS, COMPUTERS, COMPUTERS In Fiction And In Verse

D. Van Tassel, Editor. This collection of stories, commentaries and poems project the reader into a world where lifestyles are dominated by the computer to an extent far greater than they are by the telephone today. By revealing reactions and effects, the stories offer the reader insight into what is a potential reality. Cleverly-written, this book should entertain anyone who is aware of the computer's impact on society. Includes work by such distinguished writers as Gordon R. Dickson, Art Buchwald, Michael Shaara and Bob and Ray. 192 pp. $6.95 [9X].

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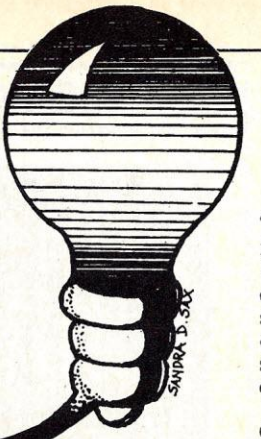

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

COMPUTERS

PRODIGY ONE FROM COMPUTER MART OF NEW JERSEY

Computer Mart of New Jersey has announced the formation of Prodigy Systems, Inc., a new division specializing in the manufacture of low cost, small business computer systems.

The Prodigy line of computers features integrated systems of hardware and software and uses Protege, a language developed specifically for use in the development of software for Prodigy's turn-key systems. The Prodigy One computer will carry a retail price of $12,000.

Prodigy Systems is currently recruiting distributors for its products. Prodigy Systems, Inc., 497 Route 27, Iselin, NJ 08830.

CIRCLE 225 ON READER SERVICE CARD

TELERAY'S "MEMORY MACHINE"

Teleray's Model 12 offers 48 lines of display memory (with a rolling 24-line window), plus 6500 characters of function memory which can be used to store display data for later editing or transmission. This "parking" memory capability expands the editing work space to 128 lines (more than 5 full pages) of data.

It can be used either interactively (e.g., data inquiry, computer-aided instruction) or for off-line editing or program development. Its expanded function memory holds up to 32 programmable functions - text, forms, control sequences loaded from either keyboard or host computer. It offers complete editing capability, including insert/delete, five-segment clear, programmable tabs and displayable control codes (monitor mode), plus five field modifiers: protect, dim, blink, inverse video and underline, programmable in any combination. $1690.

Telray, Box 24064, Minneapolis, MN.

CIRCLE 226 ON READER SERVICE CARD

SMALL BUSINESS SYSTEM

Psytek, Inc., introduces a desk top computer system. The Psytek 770 comes complete with all necessary hardware and one ready-to-run software package. Currently available standard packages include: General Ledger, Accounts Receivable, Accounts Payable, Payroll, Inventory Management, CPA Management System, and a Name and Address System.

The computer utilizes the Multibus board structure. External system storage is handled by two IBM compatible floopy disks. A 30 line by 80 column full size display screen is standard, as is a detachable keyboard with separate numeric pad. Any number of additional parallel interfaced printers may be purchased with the computer. $9,955.

Psytek, Inc., 1900 Pickwick Ave., Glenview, IL 60025 . (312) 729-3200

CIRCLE 227 ON READER SERVICE CARD

MULTI-USER COMPUTER SYSTEM

Basic Time announces a 10 million character hard disk computer system for the small business user. The B-200 is a multi-user system that will handle up to four CRT's or printers in any combination.

The single board CPU utilizes the 2901 microcomputer to emulate the 16 bit instruction set of the Data General Nova. The operating system includes full system utilities, and extended Basic with random access data files. Disk files contain diagnostics for all system devices.

A General Business Application Software package complete with documentation is included. The complete system is packaged in a desk with a separate printer stand. $19,-995.00.

Basic Time, 1215 E. El Segundo Blvd., El Segundo, CA 90245. (213) 322-4435.

CIRCLE 228 ON READER SERVICE CARD

A.C. POWER CONTROL for ALL COMPUTERS or COMPLETE TURNKEY SYSTEMS

Interface TO the **Real World** with **GIMIX Relay Driver Boards.** Connects to any Computer through a 20 ma. current loop (up to 4 Boards - 128 Relays per port).

Interface FROM the **Real World** with **GIMIX**

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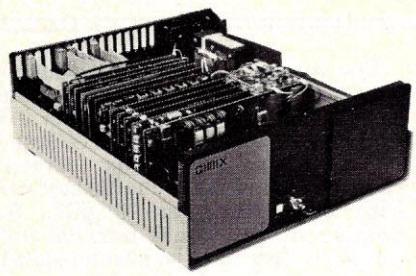
A Broad Range of 6800 Systems and Boards Compatible with the SS50 Bus



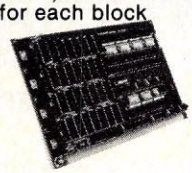
MAINFRAME: Includes chassis, power supply, switches, fan and mother board . . **$ 798.19**

16K SYSTEMS: Mainframe, plus 6800 CPU, 16K Static Ram and choice of I/O **$1344.29**
Other packages available.

16K Static RAM Boards for the SS-50 Bus

- Gold bus connectors
- 4 separate 4K Blocks
- Individual Addressing, Write Protect, and Enable/ Disable for each block

$298.13



As above with Sockets and Software control features
$368.16

All GIMIX memory boards are assembled, Burnt-In for 2 weeks, and tested at 2 MHz.
Add $32.00 for 250 ns parts

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2708's		each	**7.90**
64 or 32 x 16 VIDEO BOARD			**198.71**
80 x 24 SUPER VIDEO BOARD with user programmable RAM character generator			**458.76**
Serial I/O's	1 Port **$ 88.41**	4 Port	**198.43**
Parallel I/O's	2 Port **$ 88.42**	8 Port	**198.45**

Add $5. handling charge on orders under $200.

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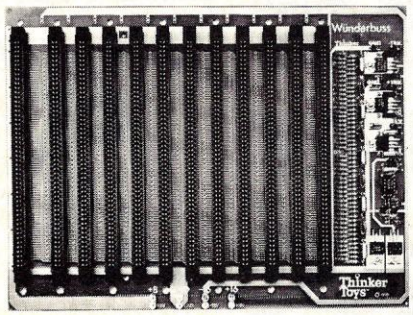
CIRCLE 150 ON READER SERVICE CARD

MEMORY



WUNDER-BUSS S-100 BUS BOARDS

Thinker Toys now has available the WunderBuss S-100 bus board in three sizes: 8-slots, 12-slots, and 20-slots. These boards all feature Noise Guard, the noise squelching system which fields signal paths and actively terminates all data lines.

Signal isolation is achieved by a cross-coupled system of ground lines which are interlaced between signal lines and cross-coupled ground planes. Further, each data line is actively terminated by a circuit which absorbs signal reflections and noise.

Thinker Toys, 5221 Central Ave., Richmond, CA 94804. (415) 524-2101.

CIRCLE 229 ON READER SERVICE CARD

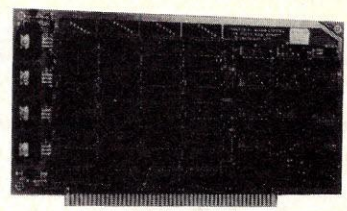
16K RAM MEMORY LITERATURE

A data sheet describes two 26Kbyte static RAM memory boards from Industrial Micro Systems.

The memories feature on-board memory management system which allows working memory to be expanded to greater than 64K. Memory access time is quoted at either 250 or 450 nanoseconds.

Other features of this S-100 bus board include a dedicated ROM option - shunt selectable - to disable from 1 to 15 Kbytes in 1K increments from either end of memory.

Industrial Micro Systems, Inc., 628 N. Eckhoff, Orange, CA 92668. (714) 633-0355.



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TEMPE, AZ 85282 TEL.: 602-966-3339

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CIRCLE 105 ON READER SERVICE CARD

Problems For Computer Solution

At last, a book of practical and stimulating exercises for teaching the basics of computer problem-solving. ***Problems for Computer Solution****, by Stephen J. Rogowski, is an ideal instructional aid. This edition is designed to encourage research and preliminary investigation through problems in many subject areas: algebra, trigonometry, arithmetic, geometry, number theory, probability, statistics, calculus and science.*

Problems for Computer Solution *is chock full of challenging problems like "The Faulty Speedometer Stopper", "The Famous Indian Problem", "Pascal's Triangle (The Challenging Way)", "Love Letter", "Telephone Book Problem", and "Computer Verse Forms". Several special interest problems are posed which deal with unsolved problems in mathematics.*

The book can be used with any computer-oriented course at the high school or college level or for self learning. Solutions in the Teacher's Edition are given in Basic, but any programming language can be used to solve the problems.

Problems for Computer Solution *costs $4.95 (106 pages, softbound).* ***Teacher's Edition*** *(with solutions) $9.95. Add $1.00 for shipping and handling. NJ residents add 5% sales tax. Substantial discounts are available on quantity orders. Call or write for information. Send order and payment to Creative Computing, Box 789-M, Morristown, NJ 07960. For faster response call in bankcard order toll free:*
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TERMINALS & I/O

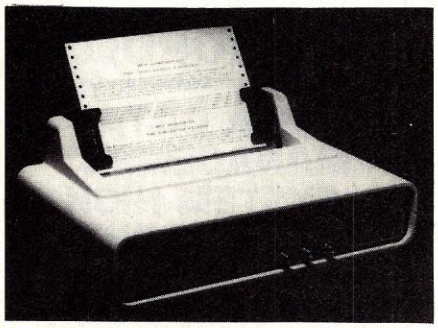
PRINTER FROM MALIBU

The Model 165 printer from Malibu can be operated in three modes: as a high-speed dot matrix printer at 165 characters per second; a reduced speed, letter-quality dot matrix printer at 90 cps; or a full-graphics matrix printer.

Applications such as computer portraits, custom character sets (Japanese, Katakana, music symbols, etc.) and hi-density characters for word processing are possible. Complete dot control is provided for 60x72 dots/inch. Some features of the 165 include: underlining, expanded characters, programmable horizontal and vertical tabs, selectable left margin, easy user-adjustable platen (up to 6-part forms) and a time-delay feature which shuts off the fan when the printer is idle. $2395.

Malibu Design Group, Inc., 8900 Eton Ave., Suite G, Canoga Park, CA 91304. (213) 998-7694.

CIRCLE 232 ON READER SERVICE CARD



MPI DOT MATRIX IMPACT PRINTER

MPI announces the Model 88T Dot Matrix Impact Printer. Features includes: 100 characters-per-second bi-directional printing and print line formats of 80, 96 or 132 columns, a full upper and lower case 96 character ASCII set printed in a 7x7 matrix for crisp, clear printing on the original plus two copies, double wide characters are software selectable and can be intermixed on any line for message high-lighting.

Forms handling is implemented with a stepper-motor driven tractor paper feed system that can be adjusted to accept fan-fold forms varying from one to 9.5 inches in width. $749.

MPI, 2099 West 220 South, Salt Lake City, UT, (801) 973-6053.

CIRCLE 233 ON READER SERVICE CARD

RADIO SHACK LINEPRINTERS

Two line printers, introduced by Radio Shack for use with their TRS-80 Microcomputer Systems, can also be used with most other computers having parallel I/O ports.

The TRS-80 Line Printer III provides full 15-inch wide 132 character lines and prints at 120 characters per second in 9x7 dot matrix upper and lower case letters.

The printing head prints in both directions as it moves across the paper. $1,999.

TRS-80 Line Printer II also produces expanded as well as upper and lower case letters using a 7x7 dot matrix format. Speed is 50 characters per second on 8-inch lines of 80 characters each. It operates in both friction-feed and pinfeed modes and can handle continuous roll paper, single sheets and continuous forms up to 9½ inches wide with an original and up to two copies. $999.

Radio Shack, 1300 One Tandy Center, Fort Worth, TX 76102. (817) 390-3272.

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CIRCLE 141 ON READER SERVICE CARD

By Netronics

ASCII/BAUDOT, STAND ALONE

Computer Terminal

COMPLETE FOR ONLY . . . $149.95

The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

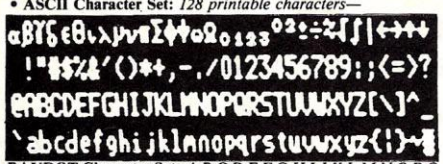
The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: *1.5 P/P into 75 ohm (EIA RS-170)* • **Baud Rate:** *110 and 300 ASCII* • **Outputs:** *RS232-C or 20 ma. current loop* • **ASCII Character Set:** *128 printable characters—*



BAUDOT Character Set: *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : • 3 $ # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

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333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- ☐ **Netronics Stand Alone ASCII Keyboard/Computer Terminal Kit, $149.95** plus $3.00 postage & handling.
- ☐ **Deluxe Steel Cabinet** for Netronics Keyboard/Terminal In Blue/Black Finish, **$19.95** plus $2.50 postage and handling.
- ☐ **Video Display Board Kit** alone (less keyboard), **$89.95** plus $3 postage & handling.
- ☐ **12" Video Monitor** (10 MHz bandwidth) fully assembled and tested, **$139.95** plus $5 postage and handling.
- ☐ **RF Modulator Kit** (to use your TV set for a monitor), **$8.95** postpaid.
- ☐ **5 amp Power Supply Kit** In Deluxe Steel Cabinet (±8VDC @ 5 amps, plus 6-8 VAC), **$39.95** plus $2 postage & handling.

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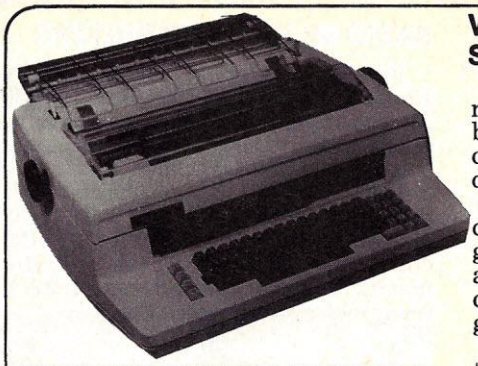
CIRCLE 175 ON READER SERVICE CARD



SPINTERM SYSTEM PRINTERS

Input Output Unlimited announces the Spinterm System printer. Consisting of two basic units; the PS-20KSR Data Terminal and the PS-10 Receive Only printer.

A print 'thimble,' variable force servocontrolled print hammer and an electronic positioner combine to provide a maximum printing speed of 55cps with sharp definition in printing quality.

Uses of the printers include; word processing, OCR, graphing and report generation. Also proportional spacing, various types of paper feeds, different print fonts, foreign language print fonts and ribbon cartridges are available as options.

Input Output Unlimited, 5922 Kester Ave., Van Nuys, CA 91411. (213) 997-7791.

CIRCLE 235 ON READER SERVICE CARD

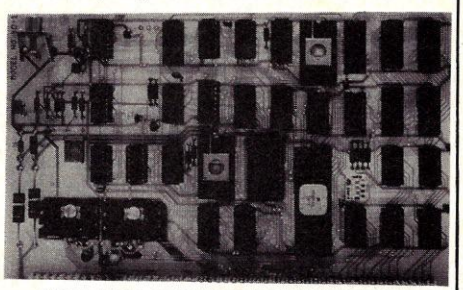
VIDEO BOARD FROM SMOKE SIGNAL

Smoke Signal Broadcasting announces its SS-50 bus video display board featuring the MC6845 CRT controller chip to provide control over display formats.

Called the VDB-1 Smoke Writer, it controls a 80x24 display with 32 graphic characters and has upper and lower case characters with lower case descenders. 128 character graphics are optional.

Other features include: reduced intensity or reversed video; programmable display rate (10-5000 characters per second); protected fields; addressable cursor; 2K video display RAM accessible by the CPU as standard RAM memory; 128 bytes of scratch p;ad RAM; and 1K EPROM for software drivers. $349.

Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91361. (213) 889-9340.



CIRCLE 236 ON READER SERVICE CARD

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CIRCLE 111 ON READER SERVICE CARD

MICROPOLIS

CCA DATA MANAGEMENT SYSTEM HIGH SPEED SORT

This high speed Mach. Lang. Sort allows Creative Computer Application's DMS sort and merge to run in at least half the normal time (depending on the file length and sort key size). This program is designed to be used with the DMS programs. It is very easily interfaced.

ALSO AVAILABLE: a machine Language Sort Utility. The utility is designed to be easily interfaced to **YOUR** BASIC programs. The sort is 100 times faster than the best written BASIC sort. We also offer a Mach. Lang. Mailing Label Program. To sort the maximum 1000 records requires 15 seconds. The output options allow for sorting by the last name or company name, zip code, and a user defined variable.

COMPLETE USERS MANUAL	**$10.00**
MAILING LABEL (ML)	**79.50**
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MACH. SORT UTILITY	**59.50**
DMS SORT PACKAGE	**69.50**

Available to be shipped immediately upon receipt of your order and payment (money order, cashier's check, Visa or Master Charge). A shipping charge of $2.00 will be added to all orders. California residents, please add 6%. Please indicate Basic 3.0 or 4.0 Ver. and memory size.

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San Diego, CA 92138
(714) 438-9137

CIRCLE 130 ON READER SERVICE CARD

MAGAZINES, JOURNALS

NEWSLETTER FOR ENGINEERS

Engineering Computer Applications Newsletter (ECAN) is designed to inform and advise engineers on how to use advanced computer technology.

The newsletter will contain articles on small computers, combining large and small computers, printers, plotters, terminals, storage units and engineering programs. The publisher, Engineering Computer Applications, Inc., promises that ECAN will be written by engineers for engineers and use of computer jargon will be minimal.

Charter subscriptions will be $24 ($30 overseas airmail) for 12 monthly issues. Requests for a *free issue* and other inquiries should be directed to: Kent Johnson, Editor, Engineering Computer Applications Newsletter, 5 Denver Tech Center, P.O. Box 3109-P2A, Englewood, CO 80111.

CIRCLE 237 ON READER SERVICE CARD

BOOKS AND BOOKLETS

GUIDE TO MICROCOMPUTERS

MicroShopper, a business and personal guide to microcomputers, has been announced by The Phoenix Group, Inc. The 72-page reference and decision-making book features 150 detailed photographs of equipment from more than 100 manufacturers representing over 500 products.

The introduction offers a common sense approach to computer jargon and business systems and software are discussed in non-technical terms. $3.95.

P.G.I. Publishing, 1425 West 12th Pl., #106, Tempe, AZ 85281. (602) 894-9247.

CIRCLE 238 ON READER SERVICE CARD

MICROCOMPUTER SELECTION GUIDE

The "Guide to Desktop Microcomputer Selection" is a new publication containing more than one hundred pages of comparative information on the TRS-80, Apple, IBM 5110, WANG 2200 Series, Hewlett-Packard 9800 Series, and the TekTronix 4050 Series microcomputer.

The Guide contains information not readily available from other sources, including a glossary of terms covering hardware and software characteristics of the computers surveyed and a comparative index to BASIC commands and syntax used by the computer. $13.65.

Atlantic Analysis Corporation, 5 Koger Executive Center, Suite 219, Norfolk, VA 23502. (804) 461-1980.

CIRCLE 239 ON READER SERVICE CARD

MICROCOMPUTER RESOURCE HANDBOOK

The First New England Microcomputer Resource Handbook, a complete guide to microcomputers and their applications, has been released by The Boston Computer Society. Topics of interest to novices, prospective purchasers and system owners are covered. Sections on product comparisons, application software, buying tips, support devices, computer stores, introductory information, publications, user groups, consultants, books, repair companies and other resources are included. A glossary which defines buzz words in terms of real life situations is also provided. $2.

The Boston Computer Society, 17 Chestnut St., Boston, MA 02108. (617) 227-9178.

CIRCLE 240 ON READER SERVICE CARD

FORT//80™

FORTRAN

for the 8080 only $99.95

- **FORT//80 is a subset of Fortran IV with many powerful enhancements!**
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- **FORT//80 is AFFORDABLE!!**

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- FORT//80 directly addresses 8080 ports as FORTRAN variables
- I/O drivers accessed via FORTRAN read/write statements
- FORT//80 accepts embedded in-line machine code
- 8080 condition codes are available as FORTRAN keywords and can be operated upon
- Multiple assignment operators accepted
- Interleaved listings and object code for quick debugging
- Symbolic names up to 31 char long simplify documentation
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- Compact; Needs only 25K for compiler and minimum workspace
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FORT//80 CPM version and manual on 8" diskette	$99.95
FORT//80 Language manual separately	20.00
FORT//80 Implementation manual	20.00
Sample diskette validation program and data	5.00

Shipping charges to US and Canada postpaid, overseas add $5.00. Please add appropriate state sales tax. Master Charge and Visa accepted.

1. FORT//80 is supplied on a single use basis, subject to the signing of a non-disclosure agreement.
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- Electrolabs Inc., Box 6721, Stanford, CA 94305, (415) 321-5601
- Arkansas Systems Inc., 8901 Kanis Rd., Little Rock, KS 72205, (501) 227-8471
- Arkon Electronics Ltd., 409 Queen St. W., Toronto, ONT M5V 2A5, (416) 868-1315

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CIRCLE 151 ON READER SERVICE CARD

FLOPPY DISCS

DOUBLE-DENSITY DRIVES FOR TRS-80

Percom Data Company announces a dual drive mini-disk unit featuring double-density storage for the TRS-80.

The TFD-1000 unit provides 800K bytes of on-line storage. Two systems (four drives) may be used with a TRS-80 to provide 1.6M bytes on line.

It is supplied complete with an interconnecting cable (accommodating one or two units), a Peripheral Adapter Module (PAM) PC card, Percom's MICRODOS operating system, and support documentation. $2495.

Percom Data Co., 211 N. Kirby, Garland, TX 75042. (800) 527-1592.

CIRCLE 241 ON READER SERVICE CARD

EXIDY DEBUTS VIDEO/DISKS

Exidy introduces a Video/Disk for the Sorcerer computer. It contains a 12" video display and dual mini-floppy disk drives with data storage capacity of 630K words. The swivel based unit attaches directly to the Sorcerer computer's keyboard enclosure to form a desktop computer system for small business data processing. Resolution is 240x512 pixels. Software included consists of CP/M, Z80 Assembler, text editor, linking loader and Microsoft Disk Extended Basic. $2,995.

Exidy Data Products, 390 Java Dr., Sunnyvale, CA 94086.

CIRCLE 242 ON READER SERVICE CARD

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Programs for PET™ Computers

The Original Cassette Magazine for the Commodore **PET.**

- Five excellent programs come to you each month on a C-30 cassette, ready to load and run.
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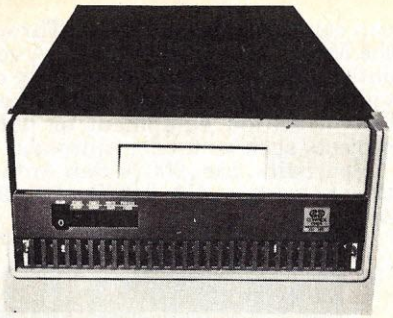
CIRCLE 156 ON READER SERVICE CARD

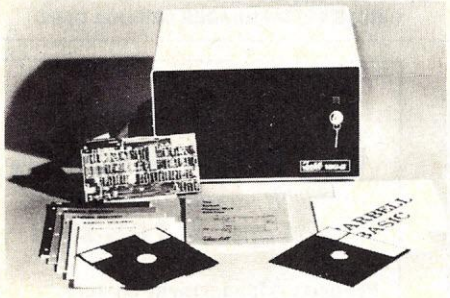


CDC'S CARTRIDGE DRIVE INTERFACED TO S-100 SYSTEMS

MicroAge Wholesale has announced the development of an interface capability for the Control Data Corporation CMD 16/16 cartridge drive to North Star and Alpha Micro-based microcomputer systems. The design permits maximum utilization of operating software due to expanded capacity and speed of the hard disk. MicroAge includes the drive, S-100 controller, software interface and disk pack in a single package. $9995.00

MicroAge, 1425 West 12th Pl., Tempe, AZ 85281. (602) 967-1421.

CIRCLE 243 ON READER SERVICE CARD



DUAL DISK DRIVE SYSTEM

Tarbell Electronics has announced the Tarbell VDS-II Vertical Disk Subsystem. The system includes two Siemens 8″ Disk Drives, Tarbell Floppy Disk Interface, CP/M Disk Operating System, and Tarbell Basic and it is packaged in a cabinet, with fan and power supply, all cables and connectors, and complete hardware and software documentation.

The VDS-II is a Shugart-compatible, single-density, single-sided dual drive system which uses standard IBM-compatible softsectored 8″ diskettes.

CP/M is the operating system for the Tarbell Floppy Disk Interface, and includes such capabilities as batch processing, text editor, assembler, debugger, compiler, copy capabilities and peripheral interchange. Tarbell Basic, included in the package, runs on 8080, 8085 or Z80 CPUs. $1888.

Tarbell Electronic, 950 Dovlen Pl., Suite B, Carson, CA 90746. (213) 538-4251 or (213) 538-2254.

CIRCLE 244 ON READER SERVICE CARD

MINI DISK DRIVE FOR TRS-80

Microcomputer Technology, Inc. announces a large capacity mini drive for the Radio Shack TRS-80.

The Model TF-7 features 77 tracks and has the largest storage capacity of any mini drive now available for the TRS-80: 195 Kbytes of on-line storage.

The MPI unit provides features found in larger 8-inch disk drives such as door lock and automatic diskette ejection. Operating software is available directly from Radio Shack. $625.

Microcomputer Technology, Inc., 2080 South Grand Ave., Santa Ana, CA 92705. (714) 979-9923.

CIRCLE 245 ON READER SERVICE CARD

DISK DRIVE FOR TRS-80

Cost Effective Computer Services announces the MF-80 mini floppy disk drive for the TRS-80. The MF-80 is directly compatible with all Radio Shack TRS-80 software and hardware. It consists of the MPI B51 drive and a heavy duty power supply enclosed in a silver case. The B-51 drive features 40 tracks, dust-tight door and diskette eject. $359.

Cost Effective Computer Services, 728 S. 10th St. Suite #2, Grand Junction, CO 81501.

CIRCLE 246 ON READER SERVICE CARD

YOU THINK YOU'VE SEEN WORD PROCESSING SOFTWARE?

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  - Print a file while editing another
- Easy page formatting
  - Simple commands set margins, page length, etc.
- Override commands at run-time
  - Give any command from the keyboard as well as in file
- Variable pitch control
  - Change pitch in mid-line, even mid-word
- Up to 128 user-defined variables
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- Form letter generation from external data files
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  - Any command may be conditional
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- Switch from specialty printer to CP/M list device
  - Print the same file on either specialty or standard printer

EASE OF OPERATION

With all its power, the MAGIC WAND is remarkably easy to use. This is no accident. The command structure is designed to be flexible and logical so that you can perform basic functions with a minimum of commands.

We have included in the manual a step-by-step instructional program, for the person who has never used a word-processor before. The trainee uses sample files from the system disk and compares his work to simulated screens and printouts.

In addition to the lessons, the manual has a complete documentation of the command structure, special notes for programmers, an introduction to CP/M for non-programmers and a glossary. The manual is typeset, rather than typewritten, for greater legibility.

We have written the manual in non-technical English, because we want you to read it. We don't overload you with a bunch of jargon that could confuse even a PhD in Computer Sciences.

We send out newsletters so that users of the MAGIC WAND can learn special applications of the print commands. For example, we might show you how to create a mailing list or set up an index for a file.

In short, we've done everything we can to make things easy for you. Because the best software in the world is just a bunch of code if you can't use it.

For more information, call or write:

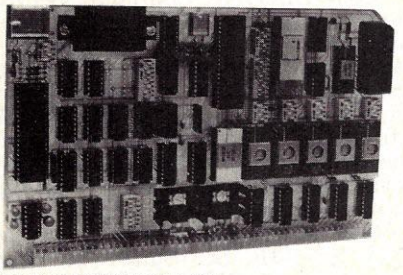
small business applications, inc.

3220 Louisiana • Suite 205 • Houston, Texas 77006 • 713-528-5158

CP/M is a registered trademark of Digital Research Corp

CIRCLE 201 ON READER SERVICE CARD

PERIPHERALS



SMOKE SIGNAL'S MULTI-FUNCTION CPU BOARD

Smoke Signal Broadcasting announced its 6800-based Super Computer Board for use as a microcontroller, business or single-board computer.

The SCB-68 features 2 MHz operation, 1K of scratch pad RAM, a 2K EPROM monitor and can address 1 MB of memory organized in 16-64K byte pages. It also provides space for up to 20K of EPROM.

Optional features include a floating point processor, RS-232 connector, real time clock and serial I/O port with two controllable output lines and programmable baud rates to 56K baud.

Available for immediate delivery.

Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91361, (213) 889-9340.

CIRCLE 247 ON READER SERVICE CARD

APPLE II SPEECH SYNTHESIZER

Computalker Consultants, announces the Model CT-IA, a speech synthesizer for the Apple II microcomputer.

The Model CT-IA is a self-contained system with its own 14″ Wx4″ Hx7″ deep chassis and 110 VAC power supply. Internally, the single interface circuitboard contains an onboard 2 Watt audio amplifier, an S-100 adapter, and an Apple II compatible edge connector. An interconnect cable and Apple controller card, manual and software package (cassette or disk) completes the package. Standard phono jacks provide connections for external speakers, headphones or hi-fi amplifier. $595. (Limited time introductory price of $495).

Computalker Consultants, 1730 21st St., Suite A, Santa Monica, CA 90404. (213) 828-6546.

CIRCLE 248 ON READER SERVICE CARD

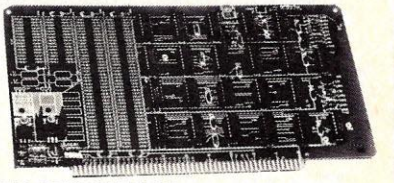
SPEECHLAB CONTROLLER CARD

Heuristics, Inc., announces its Model 70 Controller card to operate with its Model 20A Speechlab speech recognition system for use on the Apple II Computer.

The Model 70 board provides two single pole double-throw relay closures with which the serious user can control external devices. Through the Model 70 controller and 20A voice data input the Apple user easily can voice control test equipment, demonstration equipment or hobby projects such as model railroads.

Heuristics, Inc., 900 N. San Antonio Rd., Los Altos, CA 94022. (415) 948-2542.

CIRCLE 249 ON READER SERVICE CARD



VIDEO DIGITIZER

A fast-scan video digitizer that operates on data from a video camera and can be used in a variety of applications has been introduced by Vector Graphic Inc.

The device, for S-100 bus computers, converts output from the camera—or other source of composite video—into 8-bit gray scale digital information. It can be used in numerous consumer environments and in medical, security and other special-purpose applications requiring image storage and analysis. $175.

Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361. (213) 991-2302.

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PROGRAMMERS

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CONTACT

METATRON, Box 900, Amherst MA 01002.

CIRCLE 164 ON READER SERVICE CARD

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PET 2040 Dual Disk *(343K)*	$1295	$170
PET 2023 Printer *(pres feed)*	$ 849	$110
PET 2022 Printer *(trac feed)*	$ 995	$130

KIM-1 $159 (Add $30 for Power Supply)		SYM-1	$222.00
6500 Programming Manual			6.50
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2716 EPROM (5 Volt)			39.00
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6522 VIA			9.75
6520 PIA			5.50
PET 4 Voice Music Board (MTUK-1002-2)			$ 45.00
Music Software (K-1002-3C) for PET			$ 16.00
Programmers Toolkit - PET ROM Utilities			$ 45.00
Microchess 2.0 for PET or APPLE			17.90
PET Word Processor - Machine Language			24.00
3M "Scotch" 8″ disks	SALE		10/$31
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CIRCLE 197 ON READER SERVICE CARD

SOFTWARE

SYSTEMS SOFTWARE

LANGUAGES

Pascal/M brings the language power of Pascal together with the file handling capabilities of CP/M and allows the user full access to CP/M data files written in other languages and stored under CP/M. $350. Digital Marketing, 2670 Cherry Lane, Walnut Creek, CA 94596. (415) 938-2880

CIRCLE 251 ON READER SERVICE CARD

Versions of Xplo, a simplified Pascal-type language for 20K Apple II, Kim, Tim and Sym systems are currently available for under $70. The 6502 Program Exchange, 2920 Moana, Reno, NV 89509.

CIRCLE 252 ON READER SERVICE CARD

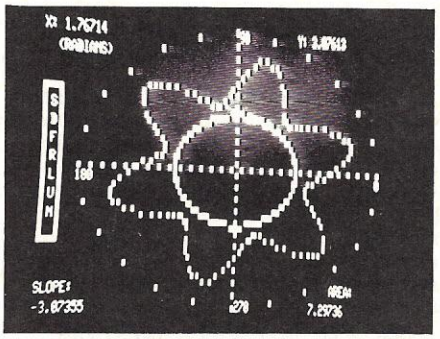
Chung/Yuen Tiny Pascal for the TRS-80 provides the Tiny Pascal compiler, text editor, Tiny Pascal monitor, sample programs and a user's manual. Side two of the cassette contains a larger compiler and complete source to the compiler written in Pascal. $40. Supersoft, P.O. Box 1628, Champaign, IL 61802. (217) 344-7596.

CIRCLE 253 ON READER SERVICE CARD

SYSTEMS

Newtech Computer Systems announces its MV-68 Multivoice Music Interpreter, which generates up to four voices of music on a single Newtech Model 68 Music Board, on miniFlex 1.0 compatible disk. Newtech Computer Systems, Inc., 230 Clinton St., Brooklyn, NY 11201. (212) 625-6220.

CIRCLE 254 ON READER SERVICE CARD



The Simplex Video Plotter for the Level II 16K TRS-80 accepts input in the form of one or two continuous functions, along with various control parameters and option selections, and produces on the video screen a two-dimensional plot of the functions. $22.50. Stephen E. Gregory, 3217 Celanese Rd., Rock Hill, SC 29730.

CIRCLE 255 ON READER SERVICE CARD

Roger's Easel allows Apple II users to draw low resolution color pictures using the computer's game paddles. Completed pictures may be saved to tape or disk and recalled later. $16.95. Southwestern Data Systems, P.O. Box 582, Santee, CA 92071. (714) 562-3670.

CIRCLE 256 ON READER SERVICE CARD

Transfer allows the user to connect any two CP/M compatible computers together with serial or parallel interfaces at any baud rate and transfer programs or files between the two machines. $49.95. Computer Services, P.O. Box 2292, Hickory, NC 28601. (704) 294-1616.

CIRCLE 257 ON READER SERVICE CARD

A communications package called IC (intersystems communications) for CP/M operating systems permits communication with other computers through a user-selected RS-232 port. Diskette only version, $150; diskette/PROM version, $200. DOC, a North Star Basic utility, aids the programmer in documenting, optimizing and maintaining the confidentiality of his programs. $59. MUFS, based on the Vector Graphic System B, is a PROM resident supervisor which allows the System B to run standard 8"disks. North Star 5¼" disks and Micropolis quad density disks. Mini Business Systems, 2461 S. Main, P.O. Box 15587, Salt Lake City, UT 84115.

CIRCLE 258 ON READER SERVICE CARD

RELIANCE

America's Most Versatile Line of Customized Audio Visual Packaging

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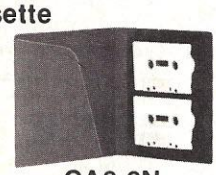
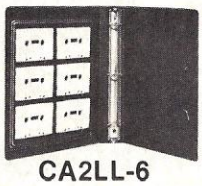


CA2-2N



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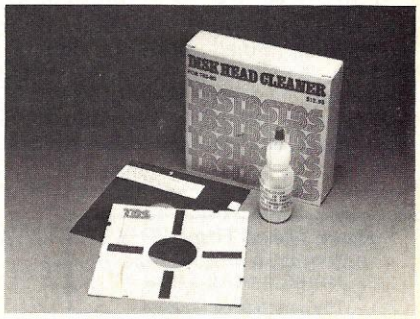

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CIRCLE 115 ON READER SERVICE CARD

Pickles & Trout announces two software packages for the UCSD Pascal operating system. Formout is a collection of routines to do formatted output from Pascal programs. $20. CPMread translates CP/M disk files to Pascal text files. $25. Pickles & Trout, P.O. Box 1206, Goleta, CA 93017. (805) 967-9563.

CIRCLE 259 ON READER SERVICE CARD

The CDS Basic Compiler enables portions of North Star Basic Programs to be compiled into assembly language to achieve increased speed and to protect proprietary sections of code. $100. Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107. (213) 793-5748.

CIRLCE 260 ON READER SERVICE CARD

The Xplo compiler for OSI computers compiles a program rather than interpreting each line. The manufacturer claims that speed is four to five times as fast as OSI Basic. $79. Pegasus Software, 1981-A St. Louis Dr., Honolulu, HI 96816.

CIRCLE 261 ON READER SERVICE CARD

Micro Data Base Systems, Inc., has announced a network DBMS written in machine language for the Z-80 CPU. DBMS routines are called from host languages and have I/O and host language interface routines isolated for easy adaption to user host language/operating system combinations. $750. Micro Data Base Systems, Inc., Lafayette, IN.

CIRCLE 262 ON READER SERVICE CARD

CRS-DOS is a comprehensive operating system for 6502 microprocessor based systems which includes a general purpose monitor package, routines for handling both serial and parallel I/O, cassette file handling, and floppy disk processing routines. $125. CGRS Microtech, P.O. Box 368, Southampton, PA 18966. (215) 757-0284.

CIRCLE 263 ON READER SERVICE CARD

Version 4 of the CIS Cobol compiler for microcomputers will be marketed under the name Standard Cobol. It is said to exploit the interactive nature of the microcomputer environment while meeting ANSI level 1 requirements for a Cobol compiler. Micro Focus Limited, 58 Acacia Rd., St. Johns Wood, London, NW8 6 AG.

CIRCLE 264 ON READER SERVICE CARD

T-Bug System Monitor is a machine language monitor designed to provide direct access to the Z-80 CPU. Editor/Assembler permits assembly language programming with the speed and efficiency of machine language combined with the convenience of a text editor and assembler. Radio Shack, 205 NW 7th St., Fort Worth, TX 76106.

CIRCLE 265 ON READER SERVICE CARD

Computer Services announces five versions of Bi-Direct for the Diable Hytype II 1610/1620 and compatible computers. All five versions print all text sent to the printer bidirectionally. $99.95. Computer Services, P.O. Box 2292, Hickory, NC 28601. (704) 294-1616.

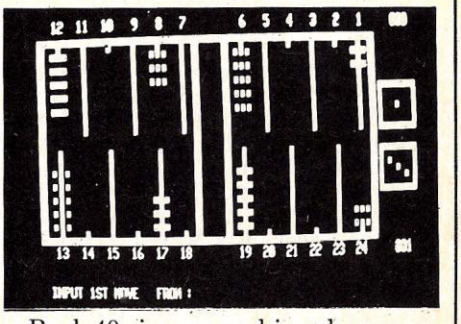
CIRCLE 266 ON READER SERVICE CARD

APPLICATIONS SOFTWARE

RECREATIONAL GAMES

Dynacomp announces a line of software for North Star and TRS-80 users, including, Bridge 2.0, Hearts 1.5, Flight Simulator and Valdez, a simulation involving the navigation of a supertanker through ship and iceberg traffic on the way to the oil port of Valdez, Alaska. Dynacomp, P.O. Box 162, Webster, NY 14580.

CIRCLE 267 ON READER SERVICE CARD



Back-40 is a machine language version of Backgammon for the TRS-80 which includes computer or player openings, computer and player doubling and scoring of all regular, gammon and backgammon endings. $14.95. Z-Chess, also for the TRS-80, features seven levels of play and accepts and plays all standard chess moves. $17.95. Dr. Chips, an Eliza-type program, is available for $14.95. The Software Association, P.O. Box 58365, Dept. CC, Houston, TX 77058.

CIRCLE 268 ON READER SERVICE CARD

Source Lib announces the release of four cassette programs for the OSI Superboard II and Challenger 1P systems. Tank Battle is an action graphics game in which one or two players must out-maneuver and destroy an enemy tank. In Sub Hunt the player must track and destroy enemy subs as they move about on a sonar screen. Word Craze is a word game in which players score points by forming words from a list of randomly generated alphabetical letters. Math Skills is a "self-quiz" program in simple arithmetic. $4.95. Source Lib, P.O. Box 970413, Miami, FL 33197.

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The Stock Exchange is a stock market simulation for the TRS-80 which includes a long account for conventional stock trading, short account for selling short, portfolio for updated accounting information, and moving news ticker which affects the trends of the everchanging prices on ten listed stocks. $15.95. The object of WhereamI? is to direct your trail of arrows to score boxes without losing yourself or banging into your opponent. $10.95. Micro-Fantastic Programming, P.O. Box 2307, Grand Central Station, New York, NY 10017.

CIRCLE 270 ON READER SERVICE CARD

Written by a programmer familiar with the NASA Shuttle Mission Simulator in Houston, Space Shuttle Landing Simulator for the Apple II gives an out-of-cockpit view of a Shuttle flight. $15. Harvey's Space Ship Repair, P.O. Box 3478, University Park, Las Cruces, NM 88003.

CIRCLE 271 ON READER SERVICE CARD

The Mean Checkers Machine is a checkers playing program written in Fortran for the TRS-80. It offers four levels of playing skill and checks all moves for legality. All jumps are optional. $19.95. Lance Micklus, Inc., 217 South Union St., Burlington, VT 05401. (802) 864-5899.

CIRCLE 272 ON READER SERVICE CARD

Among the 50 programs included in Volume 1 of Dr. Daley's PET Software Library are Trek 3, Backgammon, Conundrum, Arena and Calendar. Cassette, $49.95; disk, $59.95. Dr. Daley's Software, 425 Grove Ave., Berrien Springs, MI 49103. (616) 471-5514.

CIRCLE 273 ON READER SERVICE CARD

Dendron Amusements has announced the release of its game series for the North Star System. The series includes: Panzer, Blitzkrieg, Fall of the Third Reich, D-Day, Armorcar, Porkchop Hill, Africa Corps, Waterloo, The Battle of Monmouth, Starship Troopers, Middle Earth, Invasion of the Mud People and the Boston Marathon. $9.95. Dendron Amusements, 13 Macfarlan Ave., Hawthorne, NJ 07506. (201) 423-0381.

CIRCLE 274 ON READER SERVICE CARD

A logging package for radio amateurs, written in North Star Basic, allows amateurs to keep log records on floppy disks. Logs can be edited, merged, deleted, renamed and searched, and summaries listed on any of the seven output devices supported by the North Star system. $15. Snow Micro Systems, Inc., P.O. Box 1704, Silver Spring, MD 20902.

CIRCLE 275 ON READER SERVICE CARD

BUSINESS

Index is a data base for the assembly and upkeep of a master index of the user's program library from TRS-80 disk directories. It is menu driven and contains machine language subroutines to call and display disk directories from Basic. $19.95. Penpatch, also for TRS-80, is written in Basic and is used to modify the text of Basic programs so that they will load into the disk version of Electric Pencil. $9.95. Mumford Micro Systems, Box 435-A, Summerland, CA 93067. (805) 969-4557.

CIRCLE 276 ON READER SERVICE CARD

Radio Shack has introduced General Ledger I, an accounting system designed to post and maintain the general ledger of a small business. Disk Mailing List System for TRS-80 mini-disk owners is used to build and maintain a list of names and Cassette Mailing List System is a RAM-based Level-II program for non-disk users.

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Inventory Control System is designed to provide the user with the information needed for control of a retail inventory. Radio Shack, 205 NW 7th Street, Fort Worth, TX 76106.

CIRCLE 277 ON READER SERVICE CARD

The Project Management System for TRS-80 maintains a record of projects within a project group and provides data on up to 75 expense categories. Information can be retrieved for a specific project or group showing costs to date and comparison to budget. $116. The Time Accounting System records time expended in hours for a client by job category and hours expended for each employee by client number. $66. Inventory Control System for the TRS-80 features a master file containing quantity on hand, quantity on order, reserved stock, safety stock level, average cost, standard price, month and year-to-date sales in units and dollars, month and year-to-date cost of sale and average weekly usage. $89.95. National Software Marketing, Inc., P.O. Box 6195, Hollywood, FL 33021.

CIRCLE 278 ON READER SERVICE CARD

Taranto & Associates announces an Invoicing System for the TRS-80 designed to interface directly with the Osborne & Associates Accounts Receivable system. The system enters sales items, picks up the customer name and address from the A/R System file, computes sales taxes and prints the invoice on one of two preprinted forms. $99.95. Taranto & Associates, P.O. Box 6073, 4136 Redwood Hwy., San Rafael, CA 94903. (415) 472-1415.

CIRCLE 279 ON READER SERVICE CARD

P.M. is an equipment management/preventative maintenance software system which provides for automatic equipment maintenance scheduling and printing of matched inspection forms or labels as well as a complete search and return of up to 24 equipment parameters. Versions are available for both the general industrial and hospital environments. $1,000. Contex Systems, 1340 Galindo St., Concord, CA 94520. (415) 687-4727.

CIRCLE 280 ON READER SERVICE CARD

Micronybble Systems promises that Infobox will turn the TRS-80 into "a personal or business information box" in which the user can store, look up, save, and delete information and read information from cassette or disk. $19.95. Micronybble Systems, 63 Dana St., Cambridge, MA 02138.

CIRCLE 281 ON READER SERVICE CARD

Mailing List is a general purpose mailing label program for the TRS-80 which enables the user to start and maintain a mailing list or similar data base. The user can allow up to 61 characters for either the name/title/company or remarks/code field to meet his particular needs. $39.95. Software Industries, 902 Pinecrest, Richardson, TX 75080.

CIRCLE 282 ON READER SERVICE CARD

Creative Discount Software has designed the Project Manager System for the cost-conscious project leader who must prepare job estimates and control operating construction or engineering projects. $45. Creative Discount Software, 256 S. Robertson, Suite 2156, Beverly Hills, CA 90211. (800) 824-7888; in California, (800) 852-7777; in Alaska and Hawaii, (800) 824-7919.

CIRCLE 283 ON READER SERVICE CARD

Form Letter is a system of programs for generating, maintaining and printing multiple form letters and mailing lists. $275. Structured Systems Group, Inc., 5204 Claremont Ave., Oakland, CA 94618.

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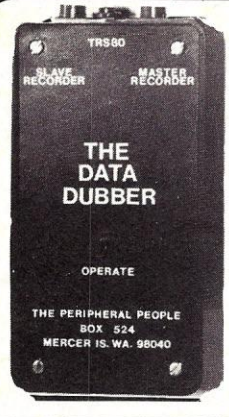

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Some Common BASIC Programs

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MICROSCOPE
January 1977

"...a welcome addition to the growing body of software aimed at people who know what they want to do with their microcomputer but don't know enough about programming to do it themselves."

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This book was designed for people who can use a variety of practical BASIC programs. It contains listings and documentation for 76 varied programs. The programs are written in a standard version of BASIC. They can be used on many of the microcomputer systems available today. The documentation is complete so only minimal programming knowledge is required to run the programs on your computer.

The 76 programs cover a wide variety of personal finance, math, statistics and general interest topics. The book gives you program listings with remarks. Examples from the Table of Contents include: Mortgage Amortization Table, Linear Interpolation, Integration, Linear Programming, Multiple Linear Regression and Tax Depreciation Schedule.

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CIRCLE 182 ON READER SERVICE CARD

Software Legal Forum

Harold L. Novick

Many people have heard of, and some have even bought, a book entitled "101 Basic Computer Games," edited by David H. Ahl, presently the publisher of Creative Computing magazine. Turning to page 2 of one of the versions, the reader discovers at least three interesting things. First, this version is in the second printing dated April, 1974, the first one being July, 1973. The copyright notice in the book reads: "Copyright 1973, 1974 by: Digital Equipment Corporation, Maynard, Massachusetts 01754." Finally, additional copies of the book can be obtained from Creative Computing.

The contents of the book are listed on pages 4, 5 and 6 and in the preface on page 7 it says, "This is not the first collection of computer games and simulations nor will it by any means be the last." So, this is a book that contains a **collection** of computer programs. The preface also informs its reader that the computer games were collected from many sources including the submission by individuals in response to a solicitation and that many of the games were rewritten or revised by the editor.

The above marshalling of "confessed" facts provides the basis for this month's adventure into the world of copyright law and protection of computer software. In a situation where one person writes the software; another obtains it from the first; a third rewrites it; a fourth edits the collection and compiles it together with others into a book; a fifth publishes and copyrights the book; and a sixth distributes it, who owns what? Translation of this query into common areas of interest for the computer software community is simple: Who can get paid for what, and who can use the software without paying anyone? Providing answers, however, is harder.

Harold L. Novick, Patent Attorney, LARSON, TAYLOR & HINDS, Arlington, Virginia 22202.

There are some more specific questions that can be more easily answered. Does the person who originally submitted the software have any rights to the program and can they collect royalties for their work even though it was rewritten? Is a book copyright valid when the book is merely a collection of other works? Whose permission of the six entities is needed and from which one of the entities can someone obtain a license so that the programs can be copied onto a floppy diskette and distributed without there being a copyright infringement?

If the foregoing questions outline a scenario that sounds familiar, it just might be because the issues arising from these questions are the same ones involved in the CP/M User Group's (CPMUG) revision and distribution of computer game software that appeared in the book "101 Basic Computer Games." Mr. Ahl was somewhat disturbed (rightly he thinks) over that situation and threatened legal action in an open letter to the CPMUG (appearing in the February, 1979 issue of Creative Computing magazine). David, however, should first have consulted page 115 of the book he thinks he is protecting before firing his guns. Perhaps by using the computer game "Gunner" he could have been more on target. But first some background information.

Surprising as it may seem, if someone assembles a number of articles, each of which is independently copyrightable, that assembly may also be copyrightable under both the old and the new copyright laws. Such an assembly is legally termed a "compilation" and because the assembly consists of a number of separate and independent works in themselves, the assembly is also legally termed a "collective work." A compilation is defined in the new copyright act, effective January 1, 1978, as a work formed by the collection and assembling of pre-existing materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship.

The "author" of a compilation is the editor, collector, or assembler, unless such person did it within the scope of employment for his or her employer. In that case, it is a "work for hire" and the author and copyright owner is the employer.

However (and there is always a catch!), protection for a compilation is conditioned and limited. Firstly, the copyright protection does not extend to any part of the compilation in which any pre-existing material has been used unlawfully. One unlawful use would be the use of a copyrighted work in the compilation without the owner's permission. Secondly, the copyright extends only to the material contributed by the author and does not imply any exclusivity of the pre-existing material. Thirdly, in order to qualify for a copyright in a collective work, the additional matter or the manner of combining the independent works must constitute more than a minimal contribution. This requirement for originality would not exist if the only contribution was the addition of a preface to a pre-existing book, but would exist, in this author's opinion, in the book "101 Basic

Forum, con't...

Computer Games" because that book contains a distinguishable variation.

But maybe the plot thickens because Mr. David Ahl in addition to collecting the computer games, rewrote, modified or cleaned up about 65% of them. That sounds like the creation of a book containing 65% "derivative works" and 35% untouched works. Derivative works are defined in the new copyright act as being based upon one or more pre-existing works which has or have been recast, transformed, or adapted. The same conditions and limitations discussed above with respect to compilations apply to derivative works. However, by definition, a derivative work has been substantially copied from the prior work and thus constitutes an infringing work if the material taken from the prior work was done without the consent of the copyright owner. A discussion of what is substantial copying is another topic best left for another month. The important point is that it does not matter if the incorporated works forming the collective work are in the public domain, are licensed copyrighted works, or are derivative works. The collective work is copyrightable and can be infringed irrespective of the source of the incorporated works. Thus, maybe the plot does not thicken.

The interesting aspect of collective works is that according to some court cases decided under the old copyright act, a work in the public domain can be converted into a work enjoying copyright protection simply by incorporating it into a copyrighted collective work. Under the reasoning in these court cases, the person copying the work in the public domain must go to the original source to avoid copyright infringement.

However, no one should get his or her hopes up. These cases have been soundly criticized and have not been followed by some other courts. Some present commentators on the law believe that the new copyright act has eliminated this possibility and argue that a work in the public domain can be copied by anyone irrespective of where that work is found.

Is this, then, the reason that David Ahl has missed his mark in his barrage at the CPMUG? No. In this author's opinion it is because permission was obtained by the CPMUG from the copyright owner, Digital Equipment Corporation, to use the programs in their book, and as the editor of the book, Mr. David Ahl, has nothing to say about it.

But more on who can rightfully claim an infringement of a collective or derivative work next time. It is time to return to star base, replenish the ship's energy and rebuild the shield power before a Klingon starts returning the fire from his starship. □

How many things
served us yesterday for
articles of faith which
today are fables to us.
Michel de Montaigne
Essays

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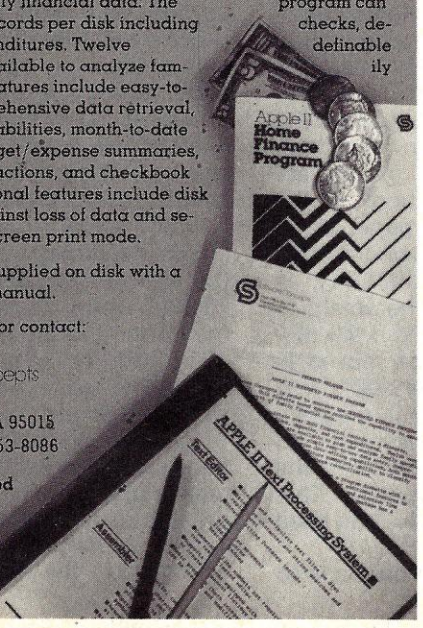

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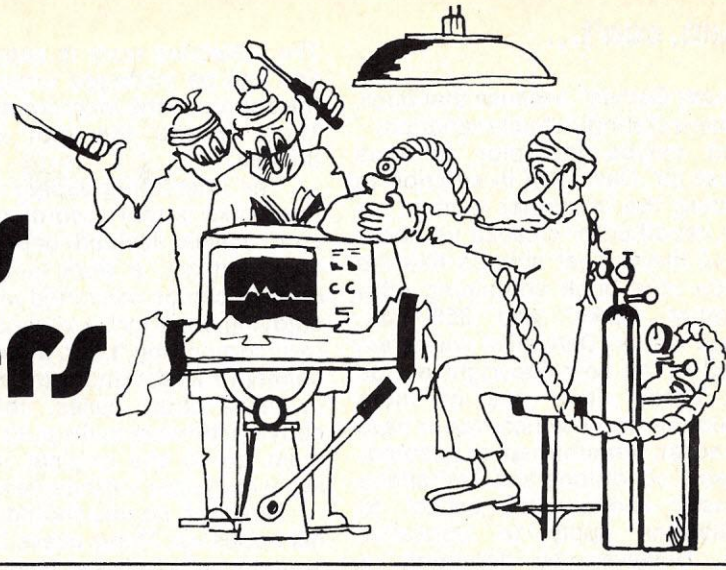
Questions & Answers



Phil Tubb

Many home computerists have found that a printer is quite useful for a variety of computer applications. But with so many computers and printers on the market, there is often a question of how to connect a printer to your computer. Glen Jenkins of Fort Devens, Massachusetts and Bill Perry of Whitinsville, Massachusetts sent in questions regarding the connection of printers to a TRS-80 system.

To understand how printers are connected, it is first useful to know what a printer does. Nearly all printers are designed to print characters using ASCII data. ASCII has 63 printing characters plus "space" if you stick to the so-called "upper case" set; and 31 more printing characters if you use the full set. It also has some special codes, the most popular of which are "return," "linefeed," and "bell." Some often used codes are "back space," "horizontal tab," "vertical tab," and "form feed." Usually the computer can send characters faster than the printer can print them. It is therefore necessary to have some system for slowing the computer down to the printer's speed. This is complicated by the fact that printers often take different amounts of time for different functions. For example, "return" usually causes a moving print head to return to the far left, and this often takes much longer than printing a single character does.

The easiest way to slow the computer down to a speed acceptable for the printer is to have it send the ASCII codes at a set speed. For example, Teletype Model 33's (a very popular teletypewriter) accept ten character codes per second. The 33 can print any character, ring the bell, or linefeed in a tenth of a second, so this rate works quite well. However, it generally takes a 33 about twice that long to return the print head. So, if you have the computer send a "return" followed by an A, the A would be smeared across the middle of the paper as the print head returns. To solve this, people often program their computers to send a "rubout" code following a return. The rubout has no particular function on a 33, and it takes up another tenth of a second. (Smarter programmers send a rubout only when the return isn't followed by a linefeed, since returns are nearly always followed by linefeeds, and the 33 can do a linefeed while it is returning.) Aside from the fact that rubouts are sometimes useful for resynchronizing the serial interfaces used by the 33, the rubout serves to fill time and such characters are often called "fill characters."

Problems with this scheme began to appear when more complicated features were added. For example, "form feed" codes are used to advance the paper to the top of the next page. Since the computer routines which run the printer are seldom written to keep track of the current position on the page, or to know the length of the page currently being used, there is difficulty in knowing how many fill characters to use. Only a few are needed if the distance the paper has to be moved is small, and several are needed if it is large. Usually people just program the computer to send enough fill characters to make it work with the maximum possible distance. This always works, but is slower than need be.

One solution to this problem is to keep the fixed transmission rate, but use a large "buffer." A good example is the popular Decwriter. This terminal can print characters at a rate of 60 per second. Linefeed and return take somewhat longer. However, the Decwriter accepts characters at a rate of 30 per second. When it is doing a return, it saves up the characters it can't print right now in the buffer. When it finishes returning, it begins printing these characters. Since it prints twice as fast as new codes come in, it catches up pretty quickly.

Both these solutions are less than desirable since they keep you waiting around while the printer is going slower than it could if it weren't for the fixed transmission rate. Obviously, variable transmission rates are the best solution. To do this, a "busy flag" is usually added. When the computer sends a character to the printer, the printer sets a signal saying that it is "busy." As soon as it is done with that character, it puts the signal back to the normal "ready" state. When the computer sees the printer is no longer busy, it sends another character. Thus, the printer can be run constantly at its highest speed, regardless of how long each function takes to complete. Often a single character buffer is added so that the moment the printer becomes "ready" a new character is sent from the buffer and the computer has lots of time to get the next character into the buffer while the printer is busy with the last one.

Usually printers which use busy flags are connected in "parallel." This means that there is one wire between the printer and the computer for each signal. Usually there are 7 or 8 wires which carry the ASCII data, a busy

Q & A, con't...

signal to the computer, and a strobe signal to the printer that tells it when another character is ready (there are also some ground wires and sometimes power wires). In contrast, "serial" printers can be connected with a single data wire, plus a ground wire, if a busy flag is not used and if the usual UART-style serializing scheme is used.

Now, onto the actual connecting together of the printer and computer, which is called "interfacing." Obviously, to run the printer at full speed a parallel interface with a busy flag is preferable. On the other hand, if the printer is to be some distance away from the computer, a serial interface is preferable to reduce the cost of the wiring.

First, a look at serial interfaces. We are privileged in this case to be dealing with the only standard for computers which is both moderately well defined and well used (unless you count 115 volt 60 Hertz AC power). This is, of course, the ever-present serial interface with the random letters and digits name; RS-232C. Thanks to well established customs, RS-232C is pretty much the same everywhere. (It is not due to specifications in the standard, which is amazingly deficient in details of any sort.) If you have an RS-232C printer and an RS-232C interface for your computer, you can probably connect them together without any trouble. (Of course you won't necessarily ever be able to write the software the computer will need to operate the printer properly...) About the only consideration has to do with the transmission rate. With a serial interface, each signal (or "bit") is sent one at a time. The data bits are surrounded by some additional control bits. There are two popular formats. One has a start bit, eight data bits, and two stop bits. The other is the same but has only one stop bit. Thus, one uses 11 bits per character and the other uses 10. The 11 bit format is generally sent at a rate of 110 baud ("baud" in this case means "bits per second") which is 10 characters per second. The 10 bit format is generally sent at rates of 300, 600, 1200, 2400, 4800 and 9600 baud for transfer rates of 30, 60, 120, 240, 480 and 960 characters per second. The format and baud rate of the printer and computer must be the same. Some printers have selectable rates and nearly all computer interface cards have selectable rates. At low baud rates, you usually need only 2 wires, data and ground. These will usually be found within an expensive 25 pin connector which is the de facto standard connector. If the printer is actually a terminal (and thus has a keyboard) you will need a third wire for the data going to the computer. If the interface is going to require more wires, then some of the 22 other RS-232C signals are being used and careful investigation will be required to know whether or not the interface will work.

Now, a look at parallel interfaces. Despite the fact that most people have their printers near their computers and would really rather have a parallel interface, and despite the fact that parallel interfaces are generally cheaper and easier to work, there are, nonetheless, relatively few parallel interfaces in use with personal computers. This is mainly because there is no universally accepted parallel interface. Everybody has their own, and nearly all are different enough to be incompatible. Sounds like cassette tape interfaces, doesn't it? Probably the most popular printer interface is the one used by Centronics. If your printer is available with a Centronics type interface, and so is your computer, you're in luck. Otherwise, order your computer and printer from the same dealer and ask to see it working before you pay (unless you're handy with electronics).

ROMS

J.C. Tobin, of Katytown, Pennsylvania, asks about adding some wiring and a socket to an OSI Challenger in order to make plug-in ROM systems. The object is to come up with ROM cartridges like the Exidy Sorcerer. He asks if the additional wiring would introduce timing, impedance, resistance, or other problems. I think that is unlikely, especially if the wires are kept short (say an inch or two). Any well designed digital system (which may well rule out all personal computers) should have a little leeway in the timing, and this extension should just reduce the leeway a little. He asks if he could obtain compatible EPROM or PROMs and if he could program them or have them programmed. PROMs can certainly be obtained if the original system used PROMs, and if it uses ROMs then the chances are still pretty good. Many suppliers of PROMs can program them for you, often at "no extra charge," but if the supplier is a large one aimed mostly at OEM's (Original Equipment Manufacturers) they will probably not be thrilled at the prospect of programming a single PROM. Overall, I think plug-in PROMs could be added, although only someone skilled in electronics would want to risk modifying his precious computer.

On the topic of ROM software, I would like to add some comments. ROM software is definitely a step in the wrong direction for personal computers. It's great for washing machines and computer-controlled toasters. Personal computers must have a disk or some similar semi-fast mass-storage device to be useful. Therefore, the only ROM should be a program to start up from the disk. Putting entire languages or operating systems in ROM is, in my opinion, incredibly foolish. (Apple started out this way, and I have always found their ROMs to be the Apple's single largest problem. Of course, their new Pascal system's Language Card—probably the forthcoming second largest problem—is a welcome step away from languages in ROM.) Most programs as large as languages and operating systems tend to contain at least one significant error, and countless minor difficulties. ROMs are hard to change. Further, a ROM can contain only one set of data. RAM (normal read/write memory) can contain any number of different sets of data (one at a time). Thus, ROM wastes addressing space lavishly. One myth that has encouraged the use of ROM is that it is the only way to have a non-erasable language, that doesn't "crash" or "die" easily. This is nonsense for two main reasons. First, you can easily design write protect circuitry for the RAM (as Apple is doing on the Language Card). With a lot of careful attention, you can even design write protect circuitry that can't be unprotected except by the loader when a new language is to be loaded (which probably no one is smart enough to do for personal computers, although they are common on large systems). Second, if a program "goes wild" and erases memory, it will do you very little good to still have the language present after your current program has been erased.

The major advantage of a ROM language is that it is there instantly when you turn the power on. Floppy disks are fast enough that you shouldn't mind waiting a couple of seconds when you first turn the machine on, especially considering all the money you'll be saving on ROMs. Plus, if the current fad is

Q & A, con't...

Pascal you can have it; and next year change to Einstein (or whatever new Super Language "all" the micros are changing over to) without replacing ROMs, buying a new ROM card, or selling your HyperCom for the HyperCom Super Plus system. Those of you who don't have disks or their equivalents yet may well want a ROM based language, but such systems are becoming rare.

8080's, Z-80's and 8085's

Kenneth Gray of Yuba City, California asks why 8080 software will run on Z-80 machines and if that means the 8080 software does not use the expanded instruction set of the Z-80. The reason is that the Z-80 has all the instructions of the 8080, plus some extras thrown in (or, as they say in the trade, "tacked on"). There are instruction codes which are "undefined" on the 8080. Intel hasn't said what they do, so if you use them you're in for trouble. Thus, most 8080 software doesn't use these codes. On the Z-80, these codes have been defined. They perform the new instructions, some of which are useful (like the relative branches) and some of which look good in the ads (like block I/O transfers at CPU speed, or the negate A instruction). Nearly all 8080 programs which don't depend on timing loops and don't use the undefined instructions will run on a Z-80 if the Z-80 has been set for 8080 interrupt mode. However, just because a program is written "for the Z-80" doesn't automatically mean it won't work on an 8080—it probably will if the new instructions aren't used. On a similar topic, 8080 software will generally run on an 8085 if timing loops aren't critical. 8085 software will generally run on an 8080 if the RIM and SIM instructions aren't used, and if the extra interrupts aren't needed. People who rave about the wonders of the Z-80 might well note that there is, indeed, a 4 MHz version of the 8080; and the 5 MHz 8085 is faster than the 4 MHz S-80, although about the same speed memories can be used for either. It's odd that the 8085 gets so little attention.

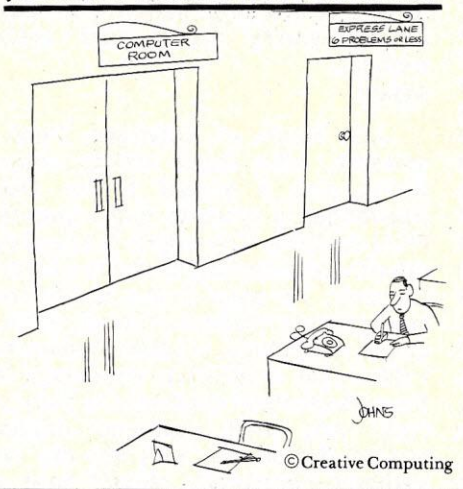
Numeric Keypad for the Apple

Kenneth Gray of Yuba City, California says that he is considering the purchase of an Apple II computer, but is concerned about the lack of a numeric keypad. While it is possible to buy some keys and wire them in (since the Apple uses contact-type switches), if you're like me the result would hardly be attractive. On the other hand, you can buy a complete unit which is ready to attach. Although I haven't seen the unit yet, AB Tech has just announced a keypad for the Apple II which is easily attached (they claim) to the encoder chip on the Apple keyboard. This means you don't have to modify your software, which you would if you connected the keys in through a parallel I/O board. The unit has 13 keys (0 through 9, period, dash and "enter"), and sells for $99. Their address is: AB Tech; 12333 Sunnyvale - Saratoga Road, Saratoga, CA 95070.

TV Bandwidth

Another question from Kenneth Gray asks about the resolution of televisions (probably for his Apple II). He says he's heard that televisions won't resolve signals above 4.5 MHz, and that for home computers the bandwidth should be 10 to 12 MHz. He asks if modifying the set to accept composite video inputs rather than RF modulated inputs will increase the bandwidth.

It is true that the bandwidth of a television is limited to around 4.5 MHz. This is necessary in order to avoid receiving adjacent stations and the sound signal, and there is little you can do about it. It is not true that for home computers the bandwidth should be 10 to 12 MHz. "Bandwidth" refers to the maximum speed at which the beam which lights up the phosper on the screen can be turned on and off, and thus refers to the number of dots which can be displayed across a line. (This is actually a definition of bandwidth as it applies to computers.) 10 MHz means the beam can be turned on and off at a rate of 10 million times per second, more or less. There are 30 full frames per second and 525 lines per frame. Thus, there are 30 times 525 lines per second, or 15,750 lines per second. (Some of this is wasted while moving the beam back to the left for the next line, and back up to the top for the next frame or for the second pass in a frame.) After you divide the 10 million rate by 15,750 you get about 635 dots. After taking out about 20% for the part of each line you don't see, this leaves about 508 dots. If you have 64 characters per line, you could have almost 8 dots per character (across). Therefore, with 64 characters of 8 dots each, a 10 MHz bandwidth would give you good dot resolution. Lower bandwidths would tend to be more smeary. The Apple II only has 40 characters across, so a lower bandwidth is acceptable.



The best thing to do is to try out your computer with the particular television and see if the image quality suits you.

With regard to direct video, this will not necessarily increase the bandwidth. Since the designers of the television know that the stages you would be bypassing will limit the bandwidth to a certain frequency, there's no reason for them to go out of their way to make the rest of the circuitry work at higher bandwidths. So, it might be higher and it might not.

A more exhaustive explanation is given in Don Lancaster's "TV Typewriter Cookbook." You can get this at your local computer store or at Radio Shack.

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Please try to keep questions general, like "what is an RS-232C interface?" rather than "how do I connect a Cray-30 terminal into my Hyperdata 80 CPU?" □

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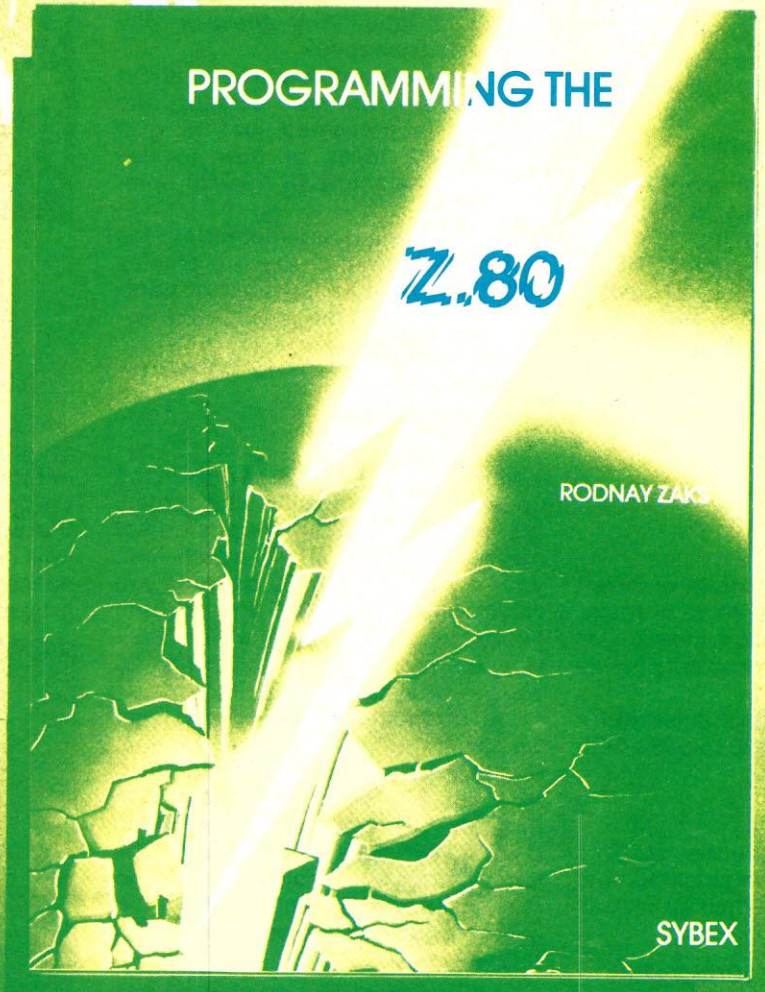
PROGRAMMING THE Z-80



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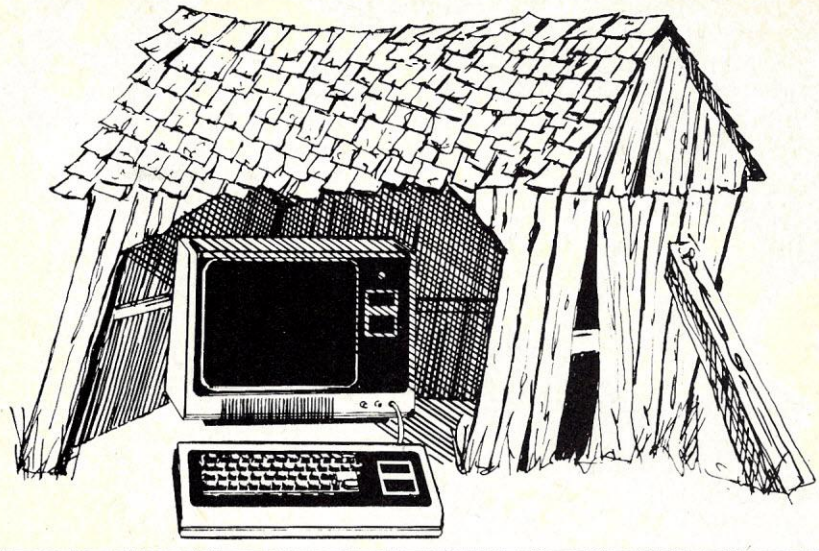
TRS-80 Strings

Stephen B. Gray



In this twelfth column, we'll have a look at computer graphics that use the 63 Level-II graphics characters, a program that helps children learn their letters and numbers, Radio Shack's software information sheets, a program that tests your RAM memory and a 48-page catalog of TRS-80 software.

Graphics-Character Graphics

No, that's not a misprint. What we're going to discuss is random-number graphics using the 63 graphics characters whose ASCII codes are 129 through 191 (sorry about that, Level-I users), and whose existence is barely hinted at in the Level-II manual.

This short program

```
10 CLS
20 A = RND(1021)
30 B = RND(63) + 128
40 PRINT    A,CHR$(B);
50 GOTO 20
```

provides a changing pattern of Level-II graphics characters, all 63 of them. Line 20 provides a random location for the character chosen randomly in line 30.

The pattern can be thinned out a trifle by changing line 30 to add a 64th character:

```
30 B = RND(64) + 127
```

which adds code 128 to the set. This is a space, a blank character. Almost the same effect can be had by instead adding

```
45 PRINT    A + 1,CHR$(128);
```

which replaces with a blank the character that's one space after the character put up on the screen by line 40.

If you use line 45 in the program, and if the 1021 in line 20 is changed to 1022, the pattern will move up now and then. If it's changed to 1023, not only will the pattern move up occasionally, but an FC error will occur sooner or later. Any guesses why these things happen?

No, there's nothing artistic about this pattern on the screen; the program is presented just to give some basic ideas of how to use graphics characters in TRS-80 computer art.

For instance, try restricting the pattern to less than the full display area. How would you go about printing the pattern in the upper left quadrant only?

Half the problem is solved by changing line 20 to

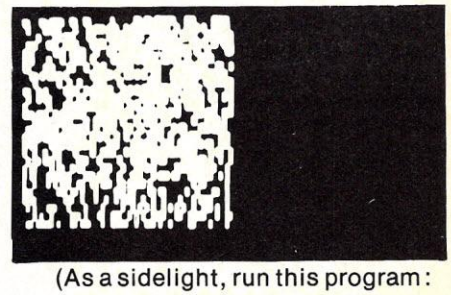
```
20 A = RND(511)
```

which displays the pattern only in the upper half of the display area. Notice that even though 511 is the position of the last character in the eighth line, you no longer get an FC error, as you would when using 1023 (the position of the last character in the 16th line). How come? Hint: try 522 in line 20 and see what happens.

As for that top-left quadrant, what we want to do is print random graphics characters in positions 0 through 31, 64 through 95, 128 through 159, etc. (see the Video Display Worksheet on page E/1 of the Level-II manual). What we want to do is to make RND(31) appear at the left half of any of the first eight lines, and this will do it:

```
20 A = RND(31) + (RND(9)-1)*64
```

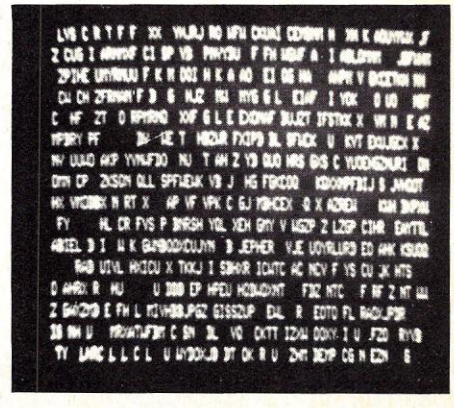
by allowing the RND(31) pattern to appear on the first line when RND(9)-1 equals 0, on the second line when RND(9)-1 equals 1 (by adding 64 to each of the character positions generated by the RND(31) function), and so on down the lines.



(As a sidelight, run this program:

```
10 CLS
20 A = RND(1021)
30 B = RND(26) + 64
40 PRINT    A, CHR$(B);
50 GOTO 20
```

and consider this question: if this program were allowed to run for a million years, would it eventually put up on the screen, letter-perfect, all the works of Ted Nelson? For your next science-fair entry, add some spaces and some punctuation to the program, and let it run for a few



hundred years as a pilot project. Isn't this much faster—and much more

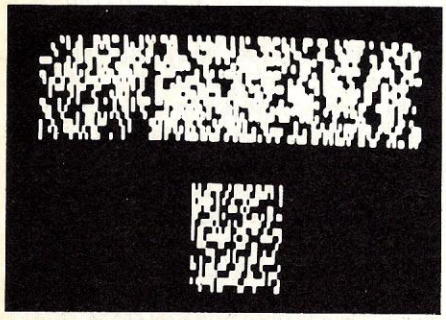
Strings, con't...

sanitary—than putting ten monkeys at ten typewriters?)

If you'd like to compare graphics-character graphics with graphics-block graphics, try this:

```
10 CLS
20 A = RND(319)
30 B = RND(63) + 128
40 PRINT   A, CHR$(B);
50 X = RND(30)
60 Y = RND(15)
70 SET(X + 50, Y + 20)
80 RESET(X + 51, Y + 21)
90 GOTO 20
```

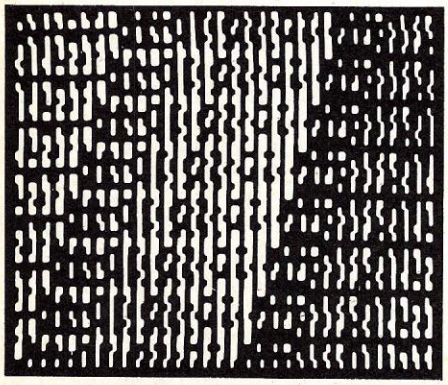
which puts a graphics-character display on the top five lines, and centered below it, a graphics-block display.



For a moving allover pattern of graphics characters, try this:

```
10 CLS
20 FOR A = 0 TO 7
30 FOR X = 129 TO 191
40 PRINT CHR$(X); CHR$(128);
50 NEXT X
60 NEXT A
70 GOTO 20
```

and if you want to make it stop after filling the screen the first time,



change line 70 to

```
70 GOTO 70
```

If the reasons for lines 20 and 60 being in the program aren't all that obvious, delete them and RUN. But not until you've tried to figure out why they're there.

A tighter pattern can be printed by dropping the CHR$(128) from the end of line 40, and changing line 20 to

```
20 FOR A = 0 TO 15
```

but don't forget to first put lines 20 and 60 back in the program. Again, the display can be "frozen" by changing line 70 to a GOTO 70.

The pattern looks a little better with

```
30 FOR X = 191 TO 129 STEP -1
```

Should you want a more regular pattern, change to

```
20 FOR A = 0 TO 29
30 FOR X = 129 TO 191 STEP 2
```

The double-width command works with Level-II graphics characters as well as with letters and numbers. For instance, in the previous program, add this line:

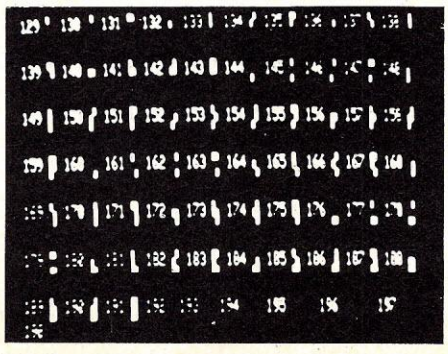
```
15 PRINT CHR$(23)
```

and the display will change to double width, called "32-character mode" in the manual.

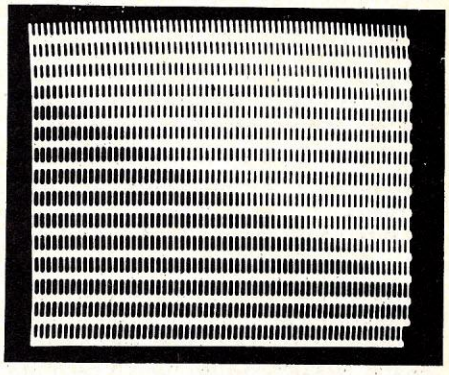
If you'd like to do some work with graphics characters, and want to know exactly which one looks like what, run this program:

```
100 CLS
110 A = 129
120 FOR X = A TO A + 9
130 PRINT X;
140 PRINT CHR$(X);
150 NEXT X
160 PRINT
170 PRINT
180 A = A + 10
190 IF A > 190 GOTO 210
200 GOTO 120
210 FOR B = 0 TO 1000
220 NEXT B
230 CLS
240 INPUT "ENTER CHAR.
NUMBER"; C
250 FOR D = 0 TO 958
260 PRINT CHR$(C);
270 NEXT D
280 FOR E = 0 TO 1000
290 NEXT E
300 GOTO 110
```

which will print a full set of graphics characters next to their ASCII character codes, give you a moment to



select one by number, ask for that number, and then print an allover pattern using that character, to show



you what it would look like in a continuous pattern.

Actually, any TRS-80 character can be used in this program, so try a letter code such as 87, or the & sign by entering 38 to get an allover pattern of ampersands.

This program displays the allover pattern for a time period depending upon the loop in lines 280-290. If you don't want the program to run over and over, and would rather RUN it each time, delete line 300. This will cause a *ready* to come up on the screen, and move the pattern up. It will also move up if you change the 958 in line 250 to 959, whether line 300 is there or not.

The loop in lines 210-220 determines how long the character set is displayed. Note that when you enter the code for any of the 63 graphics characters, these characters touch the characters in adjacent rows (well, 36 out of the 63 do, as the character-set display readily shows), as when you enter 191 or 153. But the printing characters can't be made to touch each other at top and bottom for a full allover pattern, as when you enter 38 for a field of ampersands.

To take a longer look at the chart of graphics characters, or at the overall pattern, press while holding down the shift key. When you're through looking, hit any key to "unfreeze" the display.

The graphics in the previous program can be speeded up by changing two lines:

```
250 FOR D = 15360 TO 16383
260 POKE D,C
```

Well, nothing much in the way of computer art has been developed here. The point of presenting it was to show some of the basics of what can be done with graphics characters, and to possibly get you interested in working up a short computer graphics program or two using them, and maybe then sending the programs to

Strings, con't...

me, to run in this column. The shorter the better, by the way.

Incidentally, all of these graphics programs, as well as those in previous TRS-80 columns are taken from the notebook of short programs I developed during the last year out of curiosity to see what can be done with a TRS-80.

When you write a program of any more than trivial interest, write or type it into a notebook or ring binder, with notes (or REM lines) on what it does and how. If you're at all curious about what a TRS-80 can do, you'll be quite surprised how many programs you'll generate in six months.

Happy Face

The Sel-Tronics automatic dual-cassette interface described in this column in June 1979 (p 124) was designed by Les Logan, who also wrote the bank-statement verification program that demonstrates the use of the interface.

Les has written another program, a very different one, called Happy Face. Les wrote it two years ago for the Level-I TRS-80, to teach his two-year-old son Casey, who learned his letters and numbers from it (along with a little help from TV's **Sesame Street**).

When you run Happy Face, you're first asked if you want the alphanumerics to be made with dots, or as small or large solid characters. Next you're shown a letter or number on the screen, and when you press the corresponding key on the keyboard, a happy face is displayed, and it winks its left eye. After a moment or two, the face disappears, another alphanumeric appears, and you have to find the right key to make the happy face appear again.

Simple, perhaps, but not if you're only two years old. As first written for Level-I, the program required Casey to first find the right key, and then press ENTER. As rewritten by Casey's father for Level-II, only the matching key needs to be pressed; INKEY$ takes care of the rest.

Happy Face, for Level-II 16K TRS-80, is $5 from Les Logan, 436 Warner Circle, Norfolk, VA 23509. On the cassette, Happy Face is described as "for kids 2 years old and up."

Les also wrote the Level-I Computer Doodler program (May 1979, p 130), which is now available for Level-II machines, at the same $5. The program simplifies the drawing of complex patterns.

Software Info Sheets

Because the TRS-80 catalog gives no information about software other than name and price, Radio Shack has started publishing fact sheets about these programs. They are free, and can be picked up at most Radio Shack stores, in a good-looking folder titled "Radio Shack TRS-80 Software Library."

The first sheets of software data are on games and novelty programs (Blackjack / Backgammon, Quick Watson!, Games Pack I, Microchess, Micro Music, Micro Movie, Micro Marquee), advanced programming aids (TBUG, Level-II Line Renumber, Editor/Assembler), Mailing List System and General Ledger I.

These sheets describe the programs in enough elementary detail to help you decide if you'd like to buy them, and are intended as sales aids. The more expensive the software package, the more detail is given: the $99.95 General Ledger I fact sheet is four pages long, and includes sample printouts of six different reports.

The General Ledger I and Mailing List System sheets tell just what hardware is required for these programs. General Ledger I, for instance, requires Radio Shack's "32K Business System," including a Level-II 16K TRS-80, expansion interface with 16K RAM, TRS-80 line printer and cable and two mini-disk drives.

By the time you read this, there may be many more info sheets.

RAM-Test Program

A RAM-test program that tests any 16K segment of RAM independently, or all in sequence, is available from Dick Fuller, whose RF-II switchbox was described in this column in March 1979 (p 28).

The cassette loads in a few seconds, and then a menu asks if you want to test each RAM address once, or go through the test over and over "until you decide enough is enough (overnight test)," as the instructions put it.

Three sets of numbers are presented, 00-16K, 16-32K, 32-48K, for you to put YES or NO (or just Y or N) alongside each, depending upon whether you want to test the addresses of the RAMs in the keyboard (00-16K) and/or either of the 16K in the expansion interface.

As soon as you type in the third YES or NO response, the program goes to work. The screen indicates at top left which of the three RAM sets you wish to test, and which one is being tested at the moment. At top right is the number of loops the program has gone through, if you've chosen the "overnight" test; otherwise it's zero.

Under the heading TSG you see the address being checked out at the moment. The number changes quite rapidly, with about 12 addresses being examined per second. Under BAD AD are listed up to 95 bad addresses; if your RAM has more than 95, only the last 95 will be displayed. Under FAILURES at bottom left is displayed the total number of failures.

The instruction sheet lists eight possible reasons for a FAILURE, including a bad RAM chip, incorrect power-supply voltage, a bad pin on a RAM socket and a bad address or data line. The cause may be entirely temporary. On my Level-II TRS-80 (this program works in Level-II only), the first run of the program indicated RAM failures in positions 30083 to 30106, but not on subsequent runs. The program was developed at Fuller Electronics "to help solve the problem of a flaky computer; we got many failures in the beginning; none of them were traced to a bad RAM chip!"

The program is very short, only 29 lines with a total of 53 BASIC statements, and works by first POKEing a decimal 170 (binary 10101010) into the address being tested, then PEEKing to see if that's really what is there. If it isn't, the address is printed on the screen, and what is really stored at that address is printed on the screen at lower right. The process is then repeated, by POKEing a decimal 85, which is binary 01010101, and PEEKing again.

The RAM-test tape is $14.95, from Fuller Electronics, 7465 Hollister, Suite 232, Goleta, CA 93017. Add tax in California.

Why $14.95 for such a short and simple tape? Fuller says there's overhead to be considered, that people will pay $14.95 as easily as $9.95, and besides, he adds, this is the only RAM-test tape on the market. The instruction sheet is printed too lightly to be easily read, and the spelling is atrocious (retrivel, wheather, repeted). But the test works well and fast, and is the only one in town. Until somebody starts selling a pirated version for $4.95, that is.

TRS-80 Software Exchange

What may be the biggest catalog of TRS-80 programs around is the 48-page publication of the TRS-80 Soft-

Strings, con't...

ware Exchange (17 Briar Cliff Drive, Milford, NH 03055).

The catalog is issued by the publishers of Softside and PROG/80 magazines, and includes three dozen games, such as Android Nim, Cribbage, Microchess 1.5, Mastermind II, Tycoon, Star Trek III.3, Kamikaze and Air Raid.

The ten business programs include a mailing list, general ledger, payroll, inventory and an appointment log.

Seventeen special-purpose programs are listed, including Moving Signboard, Renumber, Machine-Language Monitor, Three Monitors For Disk, Ham Radio ST80 Smart Terminal and the TEXT-80 word-processing program.

The catalog ends with half a dozen "personal" programs such as Tarot, Biorhythms, and Home Financial Management, three books and hardware accessories including cassettes, diskettes and storage boxes.

The programs are from a variety of sources, including Small System Software, Lance Miklus, BUS-80, Leo Christopherson and Computer Graphics. Most are for the 16K Level-II TRS-80, some are for the 4K Level-II or Level-I, and a few are for disk systems.

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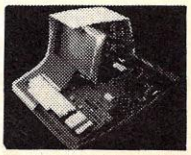

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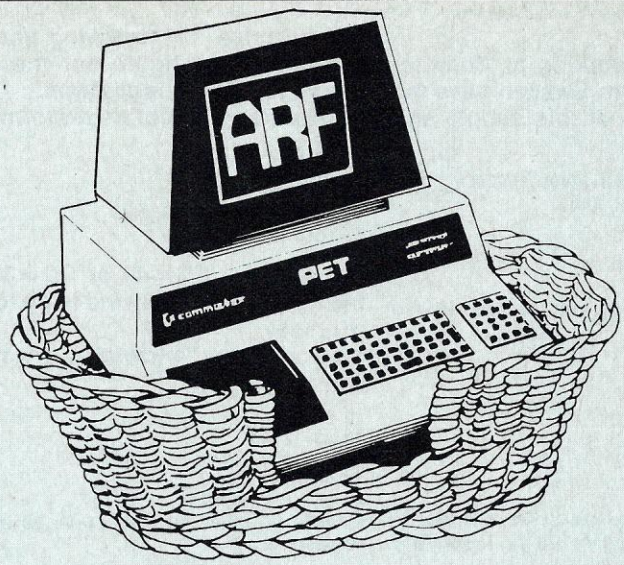

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.

On The Subject Of Software In ROM

A few columns ago, I mentioned the Programmer's Toolkit, which is a ROM mounted on a card which attaches to the PET's Memory Expansion Port. Palo Alto IC's (810 Garland Drive, Palo Alto, CA 94301) gave me a prototype to play with and I can firmly say that the Programmer's Toolkit is a "Good Thing."

While I was enjoying the pleasures of my new toy, it dawned on me that plug-in software for the PET in the form of ROM can be an immensely powerful extension to one's PET. For the effort of a SYS, my PET is immediately enhanced with the Toolkit. A few notions appeared for future PET ROM's - for example, an assembler/debugger package, a set of graphics routines for fast screen dazzles, CAI drill and practice programs, languages like PILOT or the FORTH core interpreter and more.

I am curious as to what you think are useful extensions to your PET. Drop me a note and we'll see that the idea gets to the right people.

Some Graphics Gizmos

After two columns of "heavy going" I thought it would be nice to relax and just fool around for a while - so turn on your PET, and try some of these bits of foolishness.

Enter this program:

```
10 PRINT"clr";
20 FOR J = 1 TO 1000
30 IF J AND 1 THEN PRINT "shift-)"; :GOTO 50
40 PRINT"shift-backarrow";
50 NEXT J
60 GOTO 60
```

When this is RUN, we have a good start on a Navajo rug. Now, change the J AND 1 to J AND 2. Those of you who are into optical illusions will like this one. Now try J AND 4, and so on.

About a year ago, Jack Rossum game me this little wonder:

```
10 P=32768
20 PRINT"clr";
30 FOR J=0 TO 24: FOR K=0 TO 39
40 L=(J AND K)AND(J*K)AND NOT(J+K)
50 IF L THEN POKE P+40*J=K,160
60 NEXT K
70 NEXT J
80 GOTO 80
```

A little fiddling will make this thing work faster, and removes the screen "snow" that comes from POKEing:

```
10 P=32768
20 PRINT"clr";
30 FOR J=0 TO 24: FOR K=0 TO 32
40 L=(J AND K)AND(J*K)AND NOT (J+K)
50 IF L THEN PRINT"rvs sp";:GOTO 60
55 PRINT"off sp";
60 NEXT K,J
80 GOTO 80
```

This doesn't snow, but the screen scrolls at the finish - so let's go back to the snow with these changes:

```
10 P=32768,Q=40:R=160
50 IF L THEN POKE P+Q*J+K,R
55  ---- delete this line ----
```

If the graphics characters are changed, this basic pattern can be reused in several guises. Try these changes:

```
10 P=32768:Q=40
15 C(Ø)=77 :C(1)=78
45 N=L> ØAND 1
50 POKE P+K+Q*J,C(N)
```

I wouldn't like to be a rat lost in this maze! Here are some other nice values for C(0) and C(1):

```
95   and  105

73   and  74

86   and  78
```

If you need to know the POKE code for a given graphics character, home the cursor, enter the character and then on the next line enter:

```
PRINT PEEK(32768)
```

One more variation:

```
15 C(0)=73:C(1)=74:C(2)=75:C(3)=85
40 L=(J RO K)OR (J*K) AND NOT (J+K)
45 N=L AND 3
```

If you wish, try other changes to the ANDs and NOTs in Line 40. Another set for C is the group 109, 110, 120 and 125.

Alex Breed provided me with a wallpaper maker. It goes like this:

```
10 A$=CHR$(62*RND(1)+160)
20 B$=CHR$(62*RND(1)+160)
30 FOR K= 1 TO 9
40 IF RND(1)> .5 THEN C$=C$+A$:GOTO 60
50 C$=C$+B$
60 NEXT
70 FOR K=1 TO 120: PRINT C$;: NEXT
80 FOR K=1 TO 2000: NEXT
90 CLR: GOTO 10
```

If you want more regular wallpaper, try changing line 30:

```
30 FOR K= 1 TO 10
```

Or, for variety's sake,

```
30 FOR K=1 TO 5 + 10*RND(1)
```

Sometimes the screen won't quite fill up with wallpaper each time.

Sometimes it is fun to try one's own hand at patterns. Change the wallpaper maker as follows:

```
NEW     (It's simpler to start over!)
10 INPUT "clr PATTERN:";C$
20 FOR K=1 TO 1000/LEN(C$)+1:PRINT C$: NEXT
30 FOR K=1 TO 2000: NEXT
40 GET A$:IF A$="" THEN 40
50 GOTO 10
```

Line 20 checks the length of C$ to make about one screen of wallpaper.

I will leave it up to you to try various patterns. You will discover that strings of 2, 4, 5, 8, 10 and 20 characters will make vertical patterns. The others will slide across the screen as the pattern is printed.

PET, con't...

When I was working at Commodore, a visitor from Sweden gave me the first variation of this simple animation:

```
10 REM WORM BY K. PALMISTROL, SWEDEN
20 REM TWIDDLED BY G. YOB
30 PRINT"clr";
40 A=32767+500
50 IF RND(1)>.2 THEN 70
60 Q=8*RND(1)+1
70 ON Q GOTO 80,90,100,110,120,130,140,150
80 A=A-40:GOTO160
90 A=A+41:GOTO160
100 A=A+40:GOTO160
110 A=A+39:GOTO160
120 A=A-1 :GOTO160
130 A=A-41:GOTO160
140 A=A+1 :GOTO160
150 A=A-39:GOTO160
160 POKE A,42
170 P=O:O=N:N=M:M=L:L=K:K=J:J=I:I=H:H=G:G=F:
    F=E:E=D:D=C:C=B:B=A   (O is letter O)
180 POKE C,32
190 POKE G,34
200 POKE H,81
210 POKE P,32
220 IF A>33767 THEN 130
230 IF A<32767 THEN 90
240 GOTO 50
```

RUN this program and see what you get. Line 50 decides if the worm is to change its direction. Lines 70 to 150 select one of the eight possible directions to go. Line 160 pokes the butterfly onto the screen. Line 170 stores the last 15 locations that were chosen by the worm and lines 180 to 210 draw the rest of the "worm" by erasing and adding the needed parts. Lines 220 and 230 take care of the worm exiting the screen via the home position or the lower left corner.

Since part of the fun is figuring these programs out, I won't say too much about most of them. Try them out, make a change or two, try again - and understanding will come! (Figuring them out is almost as much fun as seeing what they do.)

Changing line 210 to:

```
210 POKE P,46
```

will leave "worm tracks." If you wait about 15 minutes, the screen will be filled with the tracks.

If you want to make the program run faster, make all the constants, like 39, 1, 33767, etc., into variables first and change the lines with the constants to use the variable. The PET runs much faster if it doesn't have to convert a number from the digits into the PET's internal method of storing numbers. For example, if you had:

```
5 Q1=39
```

you can change:

```
110 A=A+Q:GOTO160
150 A=A-Q:GOTO160
```

Changing the .2 in Line 50 to other values is also interesting to do. As a last exercise, try removing line 210. See if you can figure out the result before you RUN the program.

Here is a simple "snowstorm:"

```
10 PRINT"clr";
20 AD=32768
30 BD=1000:CD=42
40 POKE AD+BD*RND(1),CD
50 GOTO 40
```

For rain, try CD = 44 or CD = 39 and the direction of the wind is up to your whimsey.

For some "snowfall", try it this way:

```
10 PRINT"clr";
20 AD=32768
30 BD=1000:CD=42
35 DL=40:ED=32
40 LC=AD+BD*RND(1)
45 POKE LC-DL-DL,ED:POKE LC-DL,ED:POKE LC,CD
50 GOTO 40
```

And for changing weather, try this one:

```
10 PRINT"clr";:C=0:AD=32768:BD=1000:DIM W(10)
      :FORJ=0TO10:READW(J):NEXT
20 C=INT(11*RND(1))
30 FORJ=1TOBD+BD*RND(1):POKEAD+BD*RND(1),W(C)
      :NEXT:GOTO20
100 DATA 39,46,44,42,33,34,58,81,87,32,32
```

Notice that the three most accessed variables, C,AD and BD, are the first three variables mentioned in the program. This is intended to make the program run as fast as possible. The placement of 8 statements in Line 10 is intended to reduce the time BASIC needs to find Line 20 when the loop is finished. This is not nearly as important in making a rapid program here.

The dedicated hacker should note that making the value 1 a variable, i.e., UN = 1, and using RND(UN) will gain more speed.

Here is another "weather" theme.

```
10 GOSUB 100
20 LC=AD+BD*RND(1):IFLC>ED THEN20
30 PL=PEEK(LC-CD):POKELC,PL:GOTO20
100 PRINT"clr";:AD=32808:BD=1000:CD=40:
    ED=33767
110 FORJ=1 TO 40:PRINT"*";:NEXT
120 RETURN
```

After enough icicles, make these changes:

```
110 INPUT"ENTER A MESSAGE";A$
120 PRINT"clr";
130 FOR J=1 TO 5+5*RND(1)
140 FORK=20 TO 150*RND(1):PRINT" sp ";:NEXT
150 PRINT A$;
160 IF RND(1)>.5 THEN PRINT
    SPC(40-LEN(A$));A$;:GOTO 160
170 NEXT:RETURN
```

Try out a few graphics entries and see what happens.

Yet another "weather" program:

```
10 PRINT"clr";
20 C$="hm rt rt rt ..... rt rt"
   (40 rt's in C$)
30 T$="dn"
40 P$=","
50 PRINT LEFT$(C$,1+42*RND(1));
60 FOR J=1 TO 24*RND(1):PRINT P$T$;:NEXT
70 GOTO 50
```

Note that the semicolon between P$ and T$ is omitted. If the PET can discern the variable's type in a PRINT statement, you don't need the semicolon.

Try T$ = "dn dn", T$ = "dn lft", T$ = "dn lft lft" for starters. For some shooting stars, try T$ = "shift-Q" and P$ = "lft , dn". If you run the "shooting stars" for a few minutes, a flaw will be revealed. See if you can fix it - and learn something about how the PET's display handles "wrap-around." Also take note of the bottom two lines of the display. Can you fix this one - without scrolling the display occasionally?

The Random Walk can be applied in a similar manner as follows:

```
10 PRINT"clr";
20 DIM M$(7)
30 FOR J=0 TO 7:READ M$(J):NEXT
40 T$="shift-Q lft"
50 PRINT"hm rt rt rt ..... dn dn dn"
   (20 rt's, 12 dn's)
60 FOR J=1 TO 100*RND(1)
70 PRINT M$(8*RND(1))T$;:NEXT
80 GOTO 50
100 DATA ".","dn",".lft dn",".
    lft lft dn",". lft lft".
    ".lft lft up",".lft up",". up"
```

Line 50 centers the cursor in the screen, and Line 70 selects one of the eight directions stored in the array M$. A different pattern appears if you change line 60:

```
60 FOR J=1 TO 20*RND(1)
```

Since M$ holds the cursor movements in a handy fashion, other programmed cursor movements can be used to make different animations. Change Lines 60 and 70:

```
60 FOR J=1 TO 40:FOR K=0 TO 7
70 PRINT M$(K)T$;:NEXT:PRINT" sp ";:NEXT
```

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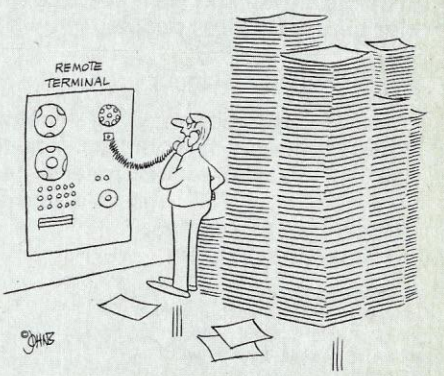


"I hate to keep bothering you people... but when do we get our turn at the computer?"

PET, con't...

Another variation on this is to make the number keys provide a directional control:

(Make these changes)

```
20 DIM M$(8),D(9)
35 FOR J=1 TO 9:READ D(J):NEXT
55 PRINT T$;:GETA$:IFA$=""THEN 55
60 GET A$: IFA$=""THEN 75
65 D=ASC(A$)-48:IFD<1 THEN 60
70 IF D>9 THEN 60
75 PRINT M$(D(D))T$;:GOTO 60
110 DATA 3,2,1,4,8,0,5,6,7
```

The ball will fly around in the direction indicated by the number key that was pressed last (5 is the center). Pressing '5' stops the ball.

This little program is not without its challenges! First, there is the project of making the screen a true "wrap-around" which involves about a dozen more lines of BASIC code. Second, if you press something other than a "0" to "9" key, you will often get a ?BAD SUBSCRIPT ERROR IN 75 and the program will stop. It's difficult to find out why this happens (It took me 5 minutes, and I'm an expert on bugs!). Here's a hint: Suppose D is some illegal value. When the program jumps to line 60, and the GET A$ returns a null string, the program then goes off to Line 75. But, the bad value of D hasn't been changed!

Simple physical models provide ideas for other graphical forms. For example, imagine a weight attached to a spring. The force on the weight depends on where the weight is and, as time passes, the force changes the velocity of the weight. Here is a little program that explores this idea:

```
10 REM WEIGHT WATCHER PROGRAM
20 M=100:K=1:V=0
30 DEF FNF(X)=-K*(X-20)
40 INPUT"POSITION(1-39):";X
50 PRINT TAB(X)"Shift-Q"
60 V=V+FNF(X)/M
70 X=X+V
80 GOTO 50
```

Line 20 says that the mass of the weight is 100 units, and that the stiffness of the spring is 1 unit. Line 30 says that the force on the weight is the stiffness of the spring multiplied by the distance the weight is from the center of the screen (that's the X-20 part). The minus sign means the force points towards the center of the screen.

The weight will wiggle faster if the mass is less, or the spring is stiffer. Try M=50 and K=2 and see what happens.

Some variations are needed since watching this contraption gets boring. One way is to "bump" the weight now and then. Here is how to "accomplish that:

```
65 IF RND(1)>.95 THEN V=V+1
```

About every 20 times, the velocity is changed by 1. Sometimes this will make the weight swing more and sometimes less. Try a position of 18 for starters. Eventually, the swing will get larger than the PET's screen and everything will smash up.

A real spring has some frictional drag as well and the following change will provide the drag:

```
65 V=.95*V
```

If that is too much, make the value larger, like V=.98*V instead. To include the "bumps" make the change at line 67 instead of 65.

Credit goes to David Kaufman for the original version of this program which he called the "dangling string."

If you want, other "force laws" can be used in line 30. Try these on for size:

```
30 DEF FNF(X)=-K*SGN(X-20)*SQR(ABS(X-20))
   Use K=10 here.

30 DEF FNF(X)=-K*(X-20)↑3
   Use K=.1 here.

30 DEF FNF(X)=-K*(X-20)↑5
   Use K=.005 here.
```

As you increase the exponent (using odd integers only), the ball looks like it is bouncing off a stiffer and stiffer wall.

Another model that I enjoy fooling with is to simulate gravity. For example, take a collection of objects with some positions and velocities, and watch what happens as gravity changes their positions. To make it easy, I started with a "one-dimensional" world, where all the objects have to be in the same line. On the PET it looks like this:

```
10 REM SLOSH BY GREGORY YOB
20 INPUT"NUMBER OF BODIES";N
25 G=10/N
30 DIM P(N),V(N)
40 PRINT"ENTER POSITIONS (1-39)"
50 FOR J=1 TO N
60 INPUT P(J)
70 NEXT J
80 PRINT"clr";
90 REM DISPLAY POSITIONS
100 FOR J=1 TO N
105 IF P(J)<1 OR P(J)>39 THEN 130
110 PRINT TAB(P(J));"Shift-Q"
120 PRINT"up";
130 NEXT J: PRINT
140 REM COMPUTE NEW VELOCITIES &
150 REM POSITIONS
160 FOR K=1 TO N
170 REM FIGURE FORCE
180 F=0: FOR J=1 TO N
190 IF J=K THEN 220
200 D=P(J)-P(K)
205 IF ABS(D)<.97 THEN 220
210 F=F+SGN(D)*G/(D*D)
220 NEXT J
230 REM FIG VELOCITIES
240 V(K)=V(K)*.95+F
250 NEXT K
260 REM DO POSITIONS
270 FOR J=1 TO N
280 P(J)=P(J)+V(J)
290 NEXT: GOTO 100
```

When this is RUN, the number of bodies and their positions are entered. The PET then computes the gravitational force for each body and the new velocities & positions. Then the positions are plotted and the computation done again. This program isn't especially fast for quite a bit of math has to be done and it gets worse for more bodies.

A few "fudges" are present to make the program behave reasonably - at the expense of being an accurate gravitational model. Line 25 adjusts the gravitational force to match the number of bodies. Without this, the runs with many bodies would move more rapidly and the runs with 2 or 3 bodies would take forever to show any changes.

The display routine uses a trick to simulate a true carriage-return. After each body is plotted, and the cursor moved to the next line, "up" is printed to put the cursor back to where it was originally.

The K loop in line 160 computes the new velocity for each body. This requires the loop in line 180 which examines the gravitational force of all the other bodies each time. Line 190 takes care to omit the body's attraction to itself (which is infinite).

Line 200 finds the distance, and line 205 is a fudge - if two bodies come close to each other, the attraction is quite strong. This results in a large "boost" to the velocity. When the new positions are figured, the bodies will be far apart, but will still keep their "boosted" speeds. This means that "close encounters" tend to add energy to the model and if you remove this line watch how everything tends to fly apart!

Line 210 adds up the forces and line 240 makes the required change to the velocities.

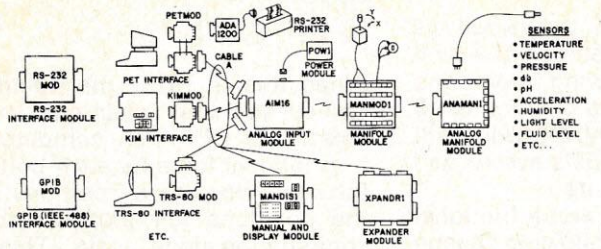
The loop in line 270-290 then computes the new positions. This can't be included in the K loop because the old positions are needed to compute the force first.

Line 240 has another fudge in it - if a body goes off at a high speed, it can "escape" and never be seen again. The .95 introduces some drag to recover escaped bodies. (There is a balance between the energy added with "close encounters" and the energy taken away with drag. The numbers used here were chosen from trial and error.)

The patterns made by SLOSH remind me of rivers and streams... □

Data Acquisition Modules

DAM SYSTEMS



The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

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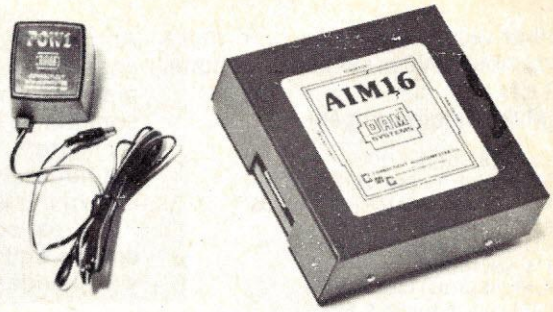
Analog Input Module



The AIM16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the DAM SYSTEMS special interfaces.

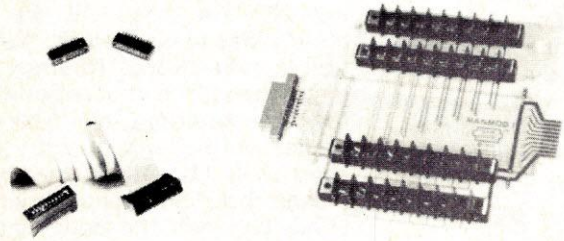
The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

Power requirements are 12 volts DC at 60 ma.

The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.

AIM16 . . . $179.00
POW1a . . . $ 14.95
POW1e . . . $ 24.95

Connectors



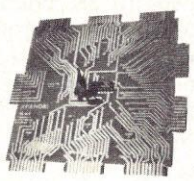
The AIM16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the DAM SYSTEMS computer interfaces and the AIM16 or XPANDR1 and between the XPANDR1 and up to eight AIM16s.

ICON . . . $ 9.95
OCON . . . $ 9.95
MANMOD1 . . . $59.95
CABLE A24 . . . $19.95

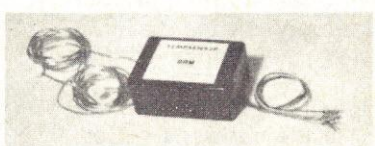
XPANDR1



The XPANDR1 allows up to eight AIM16 modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16. Up to eight AIM16 modules are then connected to each of the eight ports provided using a CABLE A24 for each module. Power for the XPANDR1 is derived from the AIM16 connected to the first port.

XPANDR1 . . . $59.95

TEMPSENS

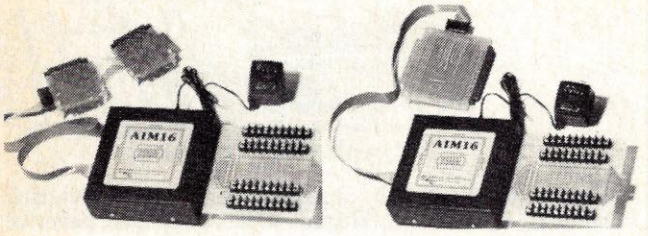


This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules).

Resolution for each probe is 1°F.

TEMPSENS2P1 (-10°F to 120°F) . . . $49.95

Computer Interfaces and Sets



For your convenience the AIM16 comes as part of a number of sets. The minimum configuration for a usable system is the AIM16 Starter Set 1. This set includes one AIM16, one POW1, one ICON and one OCON. The AIM16 Starter Set 2 includes a MANMOD1 in place of the ICON. Both of these sets require that you have a hardware knowledge of your computer and of computer interfacing.

For simple plug compatible systems we also offer computer interfaces and sets for several home computers.

The PETMOD plugs into the back of the Commodore PET computer and provides two PET IEEE ports, one user port and one DAM SYSTEMS port. The PETMOD is connected to the AIM16 or XPANDR1 with CABLE A24. The PETSET1 includes one PETMOD, one CABLE A24, one AIM16, one POW1 and one MANMOD1. To read and display a single AIM16 channel (N) using the PETSET1 the BASIC statements

```
POKE59426,N:POKE59426,255:X=PEEK(59471):PRINT"CHANNEL "N"="X
```

are all that is needed.

The KIMMOD plugs into the COMMODORE KIM applications connector and provides one application connector and one DAM SYSTEM'S port. The KIMMOD is connected to the AIM16 or XPANDR1 with CABLE A24. Assembly and machine language programs for reading and displaying data are included. The KIMSET1 includes one KIMMOD, one CABLE A24, one AIM16, one POW1 and one MANMOD 1.

All sets come in American and European versions.

AIM16 Starter Set 1a (110 VAC) . . . $189.00
AIM16 Starter Set 1e (230 VAC) . . . $199.00
AIM16 Starter Set 2a (110 VAC) . . . $259.00
AIM16 Starter Set 2e (230 VAC) . . . $269.00
PETMOD . . . $ 49.95
KIMMOD . . . $ 39.95
PETSET 1a . . . $295.00
PETSET1e . . . $305.00
KIMSET1a . . . $285.00
KIMSET1e . . . $295.00

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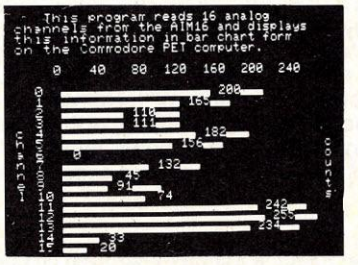
This program reads 16 analog
channels from the AIM16 and displays
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on the Commodore PET computer.
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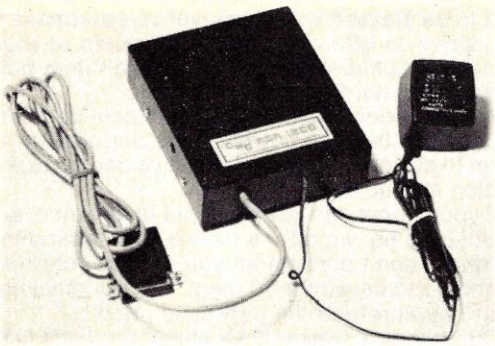

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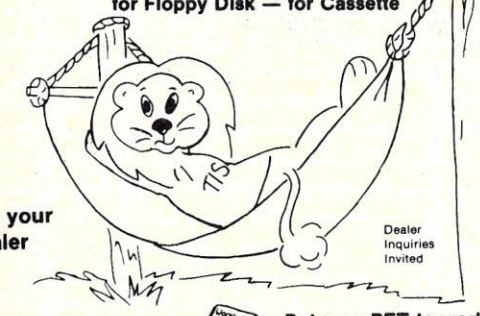

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Reviews

Stephen B. Gray

Personal Computing, by Jim Huffman, Reston Publishing Company, Inc., Reston, Virginia 22090. 254 pages, paperback $10.95. 1979.

Mr. Huffman has written an introductory book on microcomputers (yes, another one) and has done, and this is rare, a first rate job. The book is addressed to the reasonably well educated and/or intelligent person who is aware of and interested in personal computing but who does not have prior technical or computing experience. The author's aim is to help that individual get started, not to provide a complete one-volume course and reference manual on the topic. By sticking to that aim he has produced a useful and unusually readable book.

The first two chapters are introductory. There is a brief history of digital computing, from ENIAC to the micro, and a parallel discussion of the evolution of components, from tubes to large scale integrated circuit. Along the way the author manages to introduce many of the general concepts of computing, both of hardware and software. Relating these concepts to actual events and devices serves to make them less abstract and therefore more memorable.

Chapter three is a survey of the history and the current state-of-the-art in microprocessors. This discussion ranges from the first 4-bit micros up to the advent of 16-bit systems. There is an explanation of RAM and ROM and an introduction to the concept of families of chips. The chapter concludes with a comparison of some currently popular microprocessors; the 6502, Z-80, 6802 and the LSI-11.

Mr. Huffman then introduces the elements other than chips that are necessary to make up a complete and functional system. These very clear and practical explanations cover all the standard peripheral devices as well as the S-100 bus, the 20mA current loop and the RS-232 serial data link.

Subsequent chapters describe, in reasonable detail, a chip set based on the MC6800 and the use of this set to assemble a respectable beginners microcomputer designated the PC-68. The author includes a test program and some helpful hints on hardware assembly and packaging. The last chapter deals with software for the PC-68, primarily at the assembly level, and provides some useful sample programs.

An extensive set of appendices includes a list of manufacturers in the personal computer field without, unfortunately, specifying what it is that each of them manufactures. There is also the obligatory data on number systems, ASCII and full spec sheets on the chips of the 6800 family.

Mr. Huffman emphasizes the functional computing system rather than trying to give a technical dissertation on individual IC's. This is most appropriate for the reader who is not technically trained. In general the author explains the most important and most complex ideas, leaving non-critical details to be worked out by the reader, either from the given data or as part of the learning process once the reader is actually working with a computer.

The result is a better overall understanding of the system and less of the mind-deadening detail of timing diagrams and maze-like schematics. Mr. Huffman assumes you want to use a computer, not design one.

Of course no one is perfect. Mr. Huffman emphasizes PROM's and EPROM's to the neglect of RAM and barely mentions any level of software higher than assembly language. But these are matters of emphasis only. This book will help the interested reader evaluate his own requirements, make an informed choice from competing devices and get a running start in personal computing. And in that direction lies happiness and prosperity for us all. □

T.H. Lincoln/A.H. McDonough

APL: An Introduction, by Howard A. Peele. Hayden Book Co., Inc., Rochelle Park, NJ. 251 pages, paperback $8.50. 1978.

The title page says this is a "U-Program Work Text," which is explained in the preface: the book "provides a set of self-teaching materials which provide an informal introduction to APL. They are called 'U-Programs' based on the belief that you will learn APL best if you program it yourself."

Some examples show the computer's results; others have the computer's display omitted and are exercises for the reader to do. Answers are provided in the appendix.

The book is divided into nine U-Programs: Command Execution, Program Definition, Evaluating Expressions, Branching, Applying Functions, Interactive Programs, Arrays, Array Functions and Miscellaneous. These are followed by APL Bogglers, which is "a collection of APL expressions which boggle the mind," and a 16-page Summary of APL.

The book "uses a 'heuristic' approach to learning APL. That is, by examining patterns in the examples shown and from results of experiments conducted, the student may make reasonable conjectures about the nature of the APL language." Which means the entire book looks like a printout of expressions and short programs, annotated with hand-printed lecture notes by a bright student. You're shown a few examples, with a few notes, and then an arrow points to blank spaces following further expressions, with "You do these" or "What is A?" or "How many elements in L?" in the vicinity.

The "lecture notes" are short but plentiful and sufficient, and the method is one of the least painful for learning the basics of a complex high-level language. Enough examples are given for the reader to get a good idea of what's going on, and to be able to fill in the blanks, if he's been paying attention.

This is an introduction; it would be interesting to see if this heuristic approach lends itself to an advanced APL text. It should, judging from the author's skill in simplifying the teaching of the elements of APL.

Microcomputers and the 3 R's: A Guide For Teachers, by Christine Doerr. Hayden Book Company, Inc., Rochelle Park, NJ. 188 pages, paperback $7.95. 1979.

According to the back cover, "...designed for secondary school teachers and administrators, this book presents information about the educational potential of computers. It focuses on the various ways microcomputers can be used to enrich and support the average curriculum."

The first chapter looks briefly at the hardware. Chapter two looks at What The Microcomputer Offers To Education, which turns out to be relevant education, an opportunity for great teaching, increased student motivation, feedback and individualized instruction.

Chapter three tells How To Get Started, with sections on whether to build or buy, where to buy, where to put it, security, free-access computing, student computer clubs, etc.

Then five application areas are examined, with a chapter on each: computer science, problem-solving, simulations, games and computer-assisted instruction. Each includes various examples of relevant programs in BASIC. The computer-science chapter includes a syllabus and teaching notes for a six-week introductory course on computers and BASIC.

The last three chapters are Administrative Computing in Miniature (using a small system in a student information program and in a test-scores program), Where To Go For Help (special-interest groups, publications) and Deciding What To Buy, with comments on a number of current machines. Each chapter ends with a good number of references for further reading.

This compact guide is well worth the price for an introduction to microcomputers that many teachers will surely find useful.

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Visual Masters For Teaching About Computers, by Donald D. Spencer. Camelot Publishing Co., Box 1357, Ormond Beach, FL 32074. 64 pages, paperback $8.95. 1978.

Visual Masters For Teaching BASIC Programming, by Donald D. Spencer. Camelot Publishing Co. 64 pages, paperback $8.95. 1978.

Visual Masters For Teaching FORTRAN Programming, by Donald D. Spencer. Camelot Publishing Co. 64 pages, paperback $8.95. 1978.

Written by one of the most prolific authors of books on computers, programming and BASIC, these three sets of 60 visual masters are intended to be used to make transparencies for an overhead projector. As one of the three notes, "Most Xerox and bond-paper copying machines can copy the visual masters onto projection film."

The first, for teaching about computers, consists mostly of large drawings with short titles, and covers such areas as computer equipment (typical microcomputer system, typical time-sharing system, card reader, output from computers, etc.), flowcharting, computer applications (computers can draw, computers are used to control airplanes in flight, a self-service banking machine connected to the bank's computer..., etc.), computer history (abacus, Pascal's calculating machine, Mark I (1944), etc.) and several individual masters such as program development cycle, program execution and computer careers.

The drawings are well done, and most of the people shown are drawn in cartoon style to provide an added interest.

Of the three books, this one provides the most leeway for the teacher to present his or her own interpretation of the visual masters, since the titles are as short as possible.

The second, for teaching BASIC programming, is, of course, more restrictive, since it follows the author's idea of the sequence in which concepts and BASIC statements should be presented, and provides concrete examples of programs using each of the statements.

After several visual masters on the basics, such as BASIC language components, characters and symbols, basic operations and expressions, the book presents 20 BASIC statements, from LET to the MAT group, using one to three pages that give the name of the statement, a brief explanation and one or more programs using it.

The programs are all short and simple, with an average of half-a-dozen lines each, a dozen at most. The section on statements is interspersed with programs illustrating the use of several of the statements presented up to that point, such as computing the area of a washer, the number of hours a person has slept in a lifetime, determining the value of the change you have in your pocket or purse, etc.

Ten visual masters at the end of the book present a program each, for printing a table of square and cube roots, simulating the rolling of dice, Fibonacci numbers, prime numbers, coin tossing, etc. These average about 10 lines each.

The visual masters are enlivened by cartoon characters as well as occasional humorous comments in comic-strip balloons.

The third, for teaching FORTRAN programming, is a little more formal than the BASIC book, and more material is presented in a majority of the visual masters.

The book is divided into six sections, with general pages (the computer processing cycle, FORTRAN translation process, FORTRAN coding form, etc.), FORTRAN components (character set, constants, expressions, etc.), FORTRAN statements (assignment, control, DO loop, etc.), program bugs/having trouble (list of common compilation and execution errors), nine FORTRAN programs (interest calculation, permutations, square root, nth Fibonacci number, etc.) and eight FORTRAN cartoons.

While some of the programs are shown as they would be printed out, just as many are presented handwritten on coding forms. Outside of the group of FORTRAN cartoons, there are fewer cartoon characters and humorous comments than in the BASIC book.

The two language books present BASIC and FORTRAN in a sequence that most teachers should have little argument with; those who are unhappy with a visual master or two can, of course, make up their own.

All three books provide a well-thought-out plan for allowing a teacher to spend the maximum amount of class time in meaningful discussion, and a minimum amount of time at the blackboard. These pages do, indeed, as one of the introductions states, "provide classroom teachers with a selection of practical, teachable transparencies that save them considerable time and enhance their presentations."

The masters can, of course, also be used for direct projection. All are printed on 8½-by-11-inch sheets. The language visual masters should be fairly easy to correlate with most textbooks.

Payroll With Cost Accounting, by Lon Poole and Mary Borchers. Osborne & Associates, Box 2036, Berkeley, CA 94702. 371 pages, paperback $15.00. 1977.
Accounts Payable And Accounts Receivable, by Lon Poole and Mary Borchers. Osborne & Associates. 328 pages, paperback $15.00. 1978.

The back cover of the payroll book says it "includes program listings with remarks, descriptions, discussion of the principles behind each program, file layouts and a complete user's manual with step-by-step instructions, flowcharts and sample reports and CRT displays."

It is all of this, and more. A great deal of work went into the production of what must be two of the most detailed books on accounting programs ever written.

The books are written in the usual Osborne style that uses lightface type to "expand on information presented in the previous boldface type," so if you're already familiar with accounting, or have read the books once, you could skip through a great deal of material in both.

The payroll book contains listings of 35 programs in the last 131-page chapter. One of the programs is a menu of specific tasks. The other chapters describe data files, provide a management guide and a user's manual, describe the hardware used to develop and test the programs (a Wang 2200B) and the features of the BASIC involved, and tell how to change the programs for custom applications.

About a third of the AP/AR book, 93 pages, consists of source listings. As in the payroll book, remarks are provided for each program in the form of many boxed callouts included in the margins, much easier to read than REMs. The other chapters follow the style of the payroll book, including a description of the Wang 2200B hardware, and a chapter on file and program initialization.

Source listings are provided for 21 programs, one of which is a menu from which the user chooses which of the 20 remaining programs to run: accounts payable check printing with invoice detail, AP invoice aging, automatic postings to general ledger, accounts receivable progress billing, AR partial invoice payments, AR customer statements, AR invoice aging, etc.

The Accounts Payable/Receivable programs were written to share common files with the Payroll programs, as well as with the General Ledger programs described in another $15 book to be reviewed at a later date. The programs in the first two books are available on floppy disk from computer dealers, and by the time you read this, the general-ledger programs may also be available on disk.

These are handsome books, produced with the usual high quality typical of Osborne & Associates publications. The text is well written in simple style, all the illustrations are very well done, and all computer listings are as legible as possible, which is quite a rarity.

These books, incidentally, are twice the size of most of the Osborne books, and are much easier to read because the type is spread out. No eyestrain here.

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Puzzle Answers.

1. 1 mile. The trains approach each other at 10 miles per hour (6 + 4 = 10). Since they started ½ mile apart they will meet in ½/10 = 1/20 of an hour. Since the horsefly travels 20 miles an hour, he will travel 1 mile in 1/20 of an hour.

2. The method of calculating this problem is a bit strange. The final amount chipped in by each brother is in fact $2,700. The assistant took $200 from this amount leaving $2,500 which is the amount that Happy Harry actually got for his car. In actuality there is no missing $100. As for adding the $2,700 to the $200 and then subtracting the total from the original $3,000 it has no meaning at all. This is Mr. Yu's little joke.

3. As you can see from the illustration all you have to do is remove three of the inner matches. After all, I didn't say that the remaining triangles had to all be of the same size.

4. Place one lump in the first cup, two lumps in the second cup and three lumps in the third. Now, place the third cup into cup two. Each cup now contains an odd number of lumps.

5. Turn over the Quarter and **place it over** a heads nickel. The quarter completely conceals the nickel. There is now just 40 cents in heads **showing**.

6. If you write the letters out in the order in which they appear on the monument, and then place spaces in the proper places to form words, you will get in English, not Latin, the inscription "TO TIE HORSES TO". In other words, a hitching post.

7. The words are formed in the following order: SPARKLING, SPARKING, SPARING, SPRING, SPRIG, PRIG, PIG, PI, I.

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Albert Schweitzer

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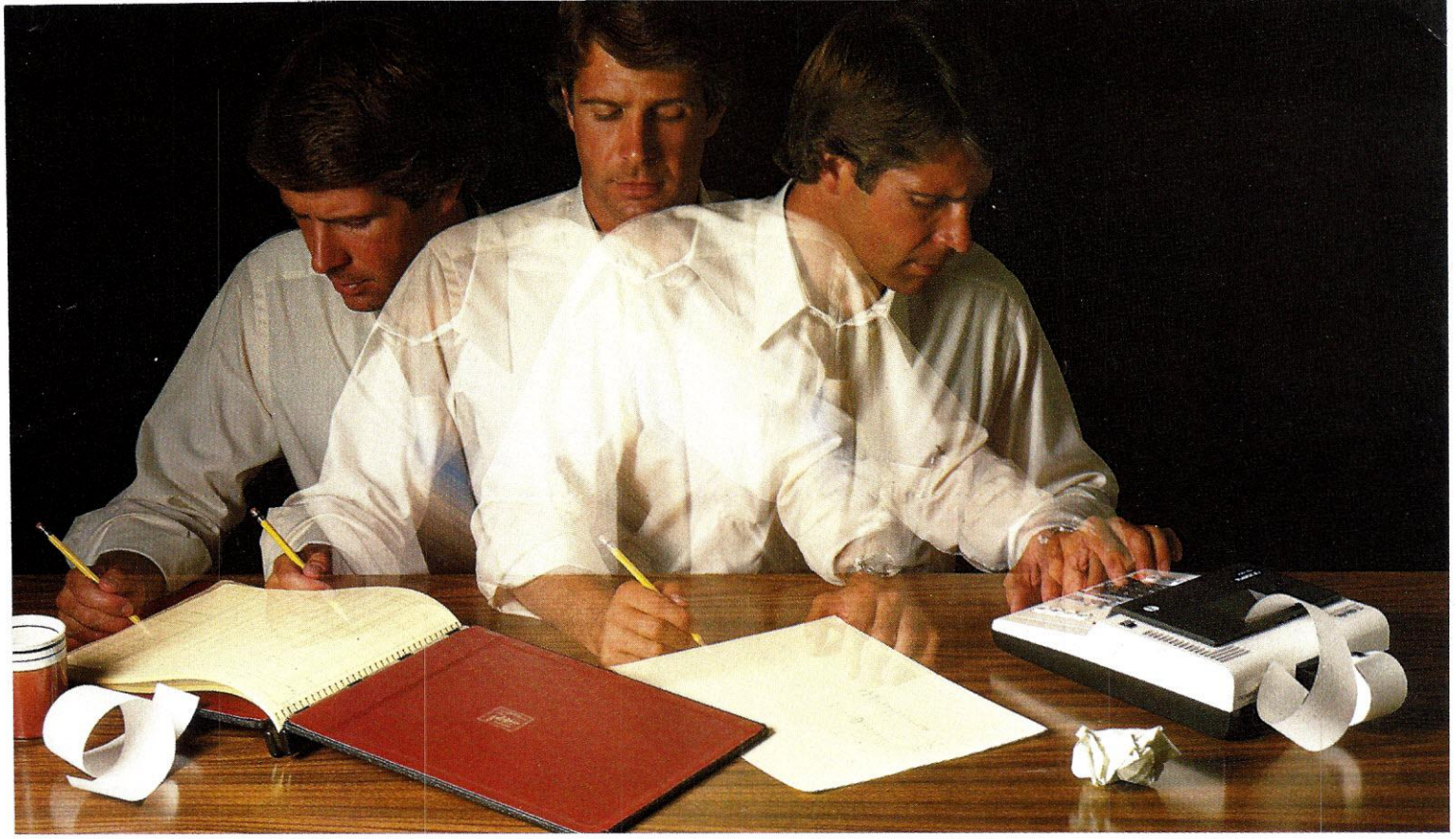

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32 x 64 with upper and lower case 2048 Characters.
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